JOINT USERS RESOURCE ALLOCATION PLANNING COMMITTEE

Thursday, November 18, 2004, 1:00 p.m.

JPL - Building 303, Room 411

AGENDA

1. **Introductory Remarks ..... G. Burke**
2. **Conflict Resolutions ..... G. Burke**
3. **Action Items ..... D. Morris**
4. **SPECIAL REPORTS:**
   - **Ka Band Calibration ..... J. Breidenthal**
   - **Deep Impact Launch Status ..... J. Call / R. Benson**
   - **Cassini & Huygens Probe Status ..... D. Doody**
   - **COMM Preventive Maintenance ..... J. Holladay / M. Alvarez**
5. **Resource Analysis Team ..... E. Hampton**
   - **Mid-Range Status**
   - **DSN Downtime Forecast**
   - **RARB Summary of Mission Changes**
   - **Special Studies Summary:**
     - **Mars Reconnaissance Orbiter Mission Support Update**
     - **SOHO – Impact in 2005 of Weekly 26m Subnet 4 hour maintenance for Receiver Phasing**
     - **SOHO – Analysis of Keyhold Periods in 2007**
     - **Stereo Ahead and Behind Mission Support Update**
     - **Ulysses Continuous Coverage Question in 2005 (Swift – GRB)**

Action Item Status From 10 August 2004 RARB

(Resource Allocation Review Board)

November 18, 2004

David G. Morris

Action Item Summary

AI#	Year	Month(s)	System	Responsible	Due Date	Status
01	2006	July-August	GSSR	M. Slade	12/17/2004	Pending

ACTION: Coordinate with Scientist representing Mercury Radar Speckle Displacement Co-observation with Green Bank Telescope or Arecibo Observatory on recommendations to minimize contention in these months.

RESPONSE: (9/16/2004) This action item was needed to reduce heavy contention for DSS-14, since Mars, Jupiter, and Mercury are close together in the sky in July 2006. Prof. Margot is the PI for this observation and will be visiting JPL in December 2004. We are attempting to schedule a meeting with Cassini , Mars Odyssey, and other interested parties at that time.

Jet Propulsion Laboratory
California Institute of Technology

Joint Users Resource Allocation Planning

Action Item Summary

AI#	*Year*	*Month(s)*	*System*	*Responsible*	*Due Date*	*Status*
02	**2006**	**August-September**	**Mars Missions**	**C. Edwards B. Mase K. Zamora**	**11/10/2004**	**Closed**

ACTION: Coordinate MGS, Odyssey and MEX coverage during the MRO Aerobraking period.

RESPONSE: (10/22/2004) The Multi-Mission DSN Allocation Planning Team will provide an integrated schedule using MSPA when possible that will coordinate the needs of these four missions. This should reduce conflicts while satisfying their contact needs. Specifically, each Mars Mission responded as follows:

- MRO feels that it needs to reserve full commanding (U/L and D/L) during Aerobraking (Weeks 36-39) to ensure successful commanding of their large spacecraft command loads. MRO does not concur with RAPSO recommendations to MSPA.
- Mars Express (MEX) should be able to live with downlink only in September 2006.
  - Extra track per day for extra science data, should be no impact, particularly if done with MSPA.
  - One Bistatic radar proficiency track, may be affected as it requires an uplink. Should be proficient from a previous Bistatic Radar Campaign.
  - Solar Corona will be lost, but there are 9 weeks in this campaign, during solar conjunction.
- Odyssey (M01O) is willing to MSPA, when possible. Minimum requirements for commanding are Tuesday and Thursday.
- MGS is willing to MSPA, when possible.

Action Item Summary

AI#	*Year*	*Month(s)*	*System*	*Responsible*	*Due Date*	*Status*
03	**2006**	**December**	**SOHO**	**B. Dutilly**	**10/14/2004**	**Closed**

ACTION: During Antenna Keyhole activities, the recommendation is to use 34m antennas versus 70m antennas due to oversubscription of the 70m subnet. 26m antenna usage was not in question.

RESPONSE: (8/26/2004) SOHO requires a minimum of four(4) hours of 70M coverage every 45 hours of gap time during a keyhole event. The purpose is to dump the SSR during that pass otherwise critical science data will be lost. We will continue to negotiate the time and resources needed in the mid range period for 70M support.

Interplanetary Network Directorate

DSMS System Engineering

Ka-band Calibration

Presented by

Jay Breidenthal

IND System Engineering and Standards Office (912)

David Rochblatt

Antenna Microwave Engineering Group (333J)

November 18, 2004

Introduction

- **Why are we here?**
  - **Standing practice of calibrating the pointing of 34m BWG antennas once per year**
  - **Recent experience shows that antennas drift much faster than expected**
  - **Antennas need to be calibrated more often to serve Ka-band customers**
- **Agenda**
  - **What are the Ka-band pointing requirements?**
  - **How have we been doing at meeting them?**
  - **What goes into making a good pointing calibration?**
  - **Impacts on scheduling**

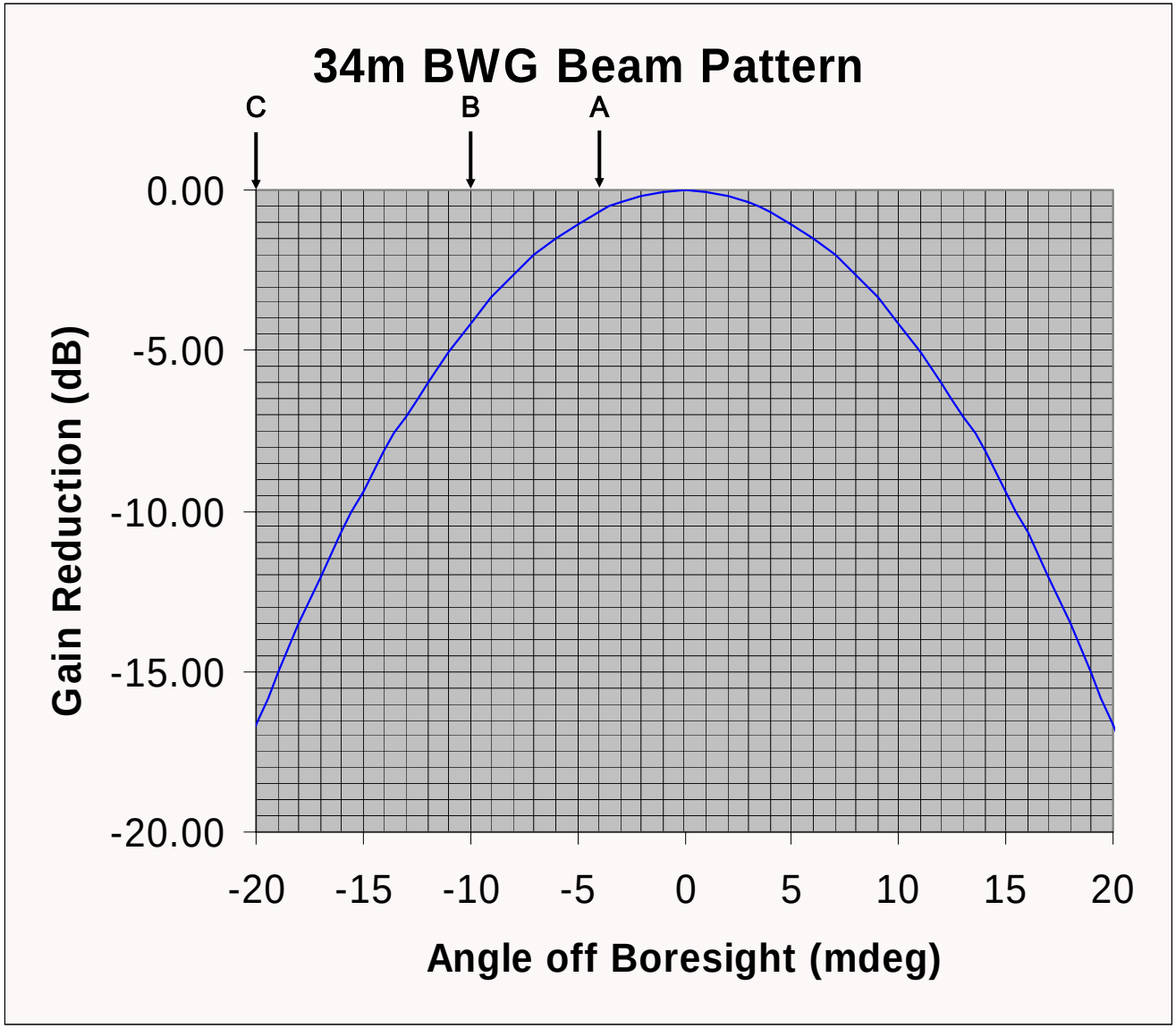
Ka-band Pointing Requirements

- **Blind Pointing on 34m BWG antennas**
  - **Customer need: 2 millidegrees**
    - Spacecraft amplitude stability for Radio Science
  - **DSMS-internal need 1: 2.5 millidegrees**
    - All-sky detectability of quasars for navigation (delta-DOR, earth rotation, clock sync)
  - **DSMS-internal need 2: 10 millidegrees**
    - Capture range for monopulse - spacecraft only
  - **Committed capability: 4 millidegrees**
    - Waiver to requirements based on limits set by structure, wind, thermal effects, servo performance -- too expensive to cure
- **Monopulse Pointing on 34m BWG antennas**
  - **Customer need: 1.6 millidegrees when SNR > 26 dB-Hz**
    - Based on 3% (0.11 dB) power loss for telemetry
    - A 3 millidegree error produces 10% (0.4 dB) power loss can cause complete loss of telemetry signal

How Big is 4 Millidegrees?

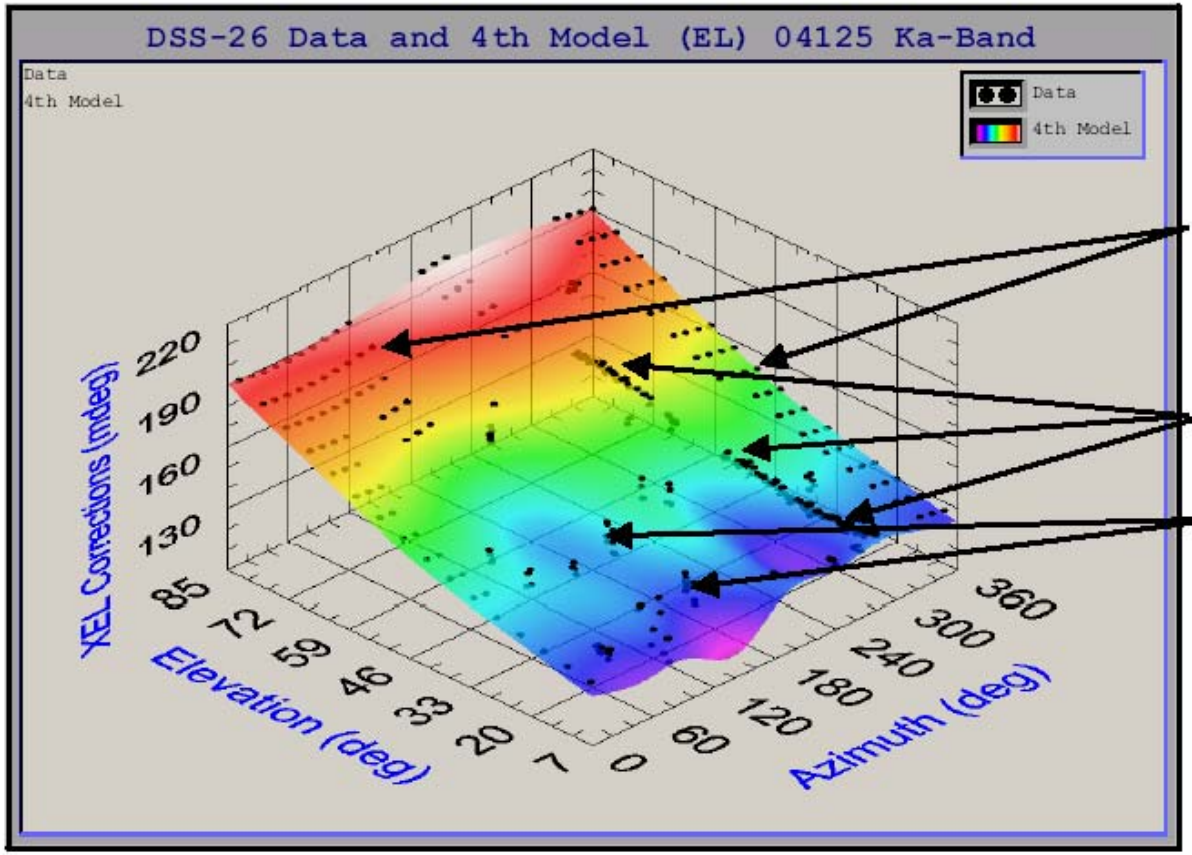
→ · ←

The dot midway between the arrows covers 4 mdeg at 1 meter distance



A = commited
B = monopulse pull-in
C = decayed

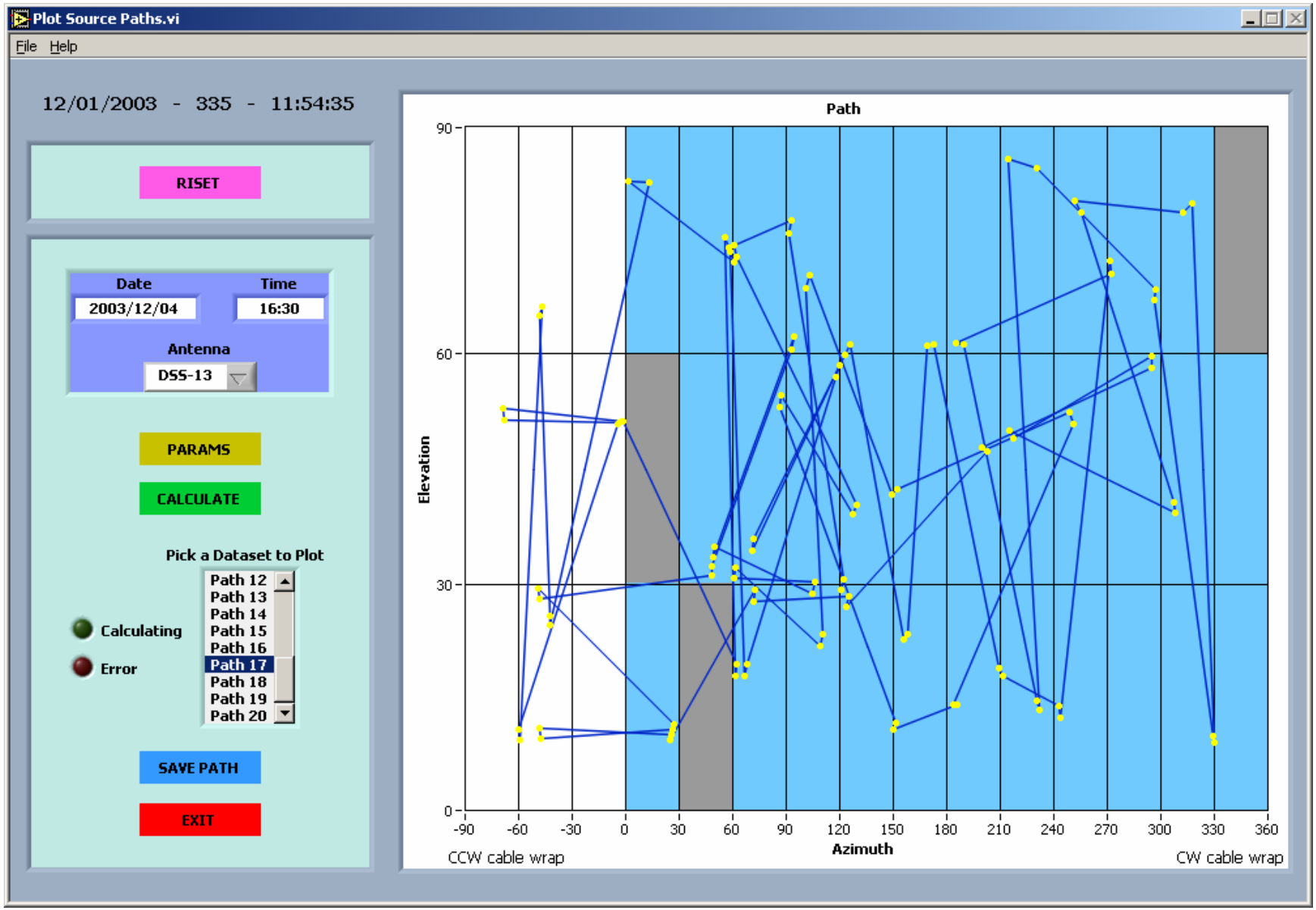
A Typical Pointing Error Model



1. Notice prev. 1st model includes All previous data from CONSCAN Radio source tracks, etc is used Where other data is not available
2. Saturn data at Ka-Band is Used as much as possible
3. Radio sources tracks at Ka-Band is used for all-sky fill And where Saturn data is not available

A Typical Observing Plan

- **This Example: estimate 4-hrs to complete the observation**

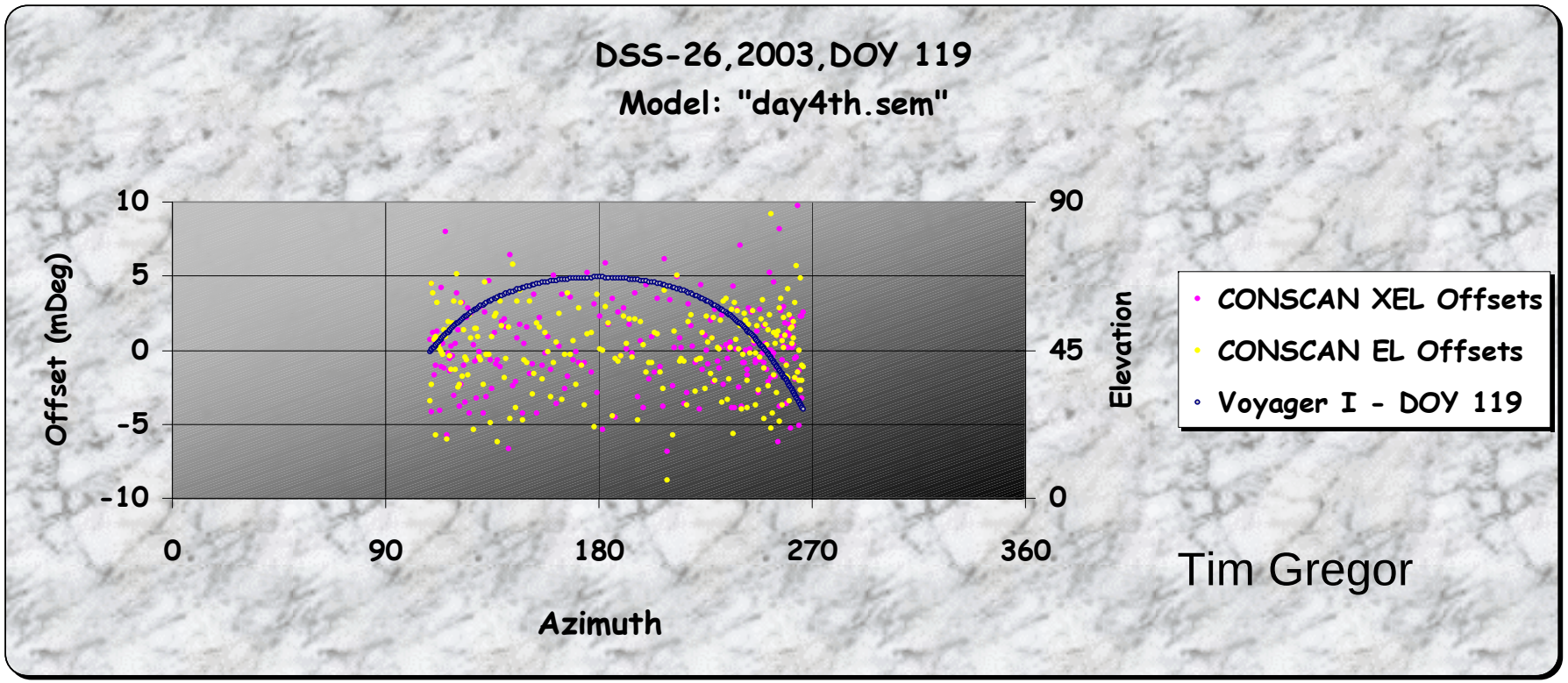


How Have We Been Doing?

- **Customer feedback:**
  - **"The BWG antennas point so poorly at Ka-band that they are unusable for VLBI..."**
  - **"My gut feeling is that the current system has 10 to 20 mdeg pointing errors when run open loop over the full sky"**
- **Calibration experts:**
  - **When data is taken all over the sky, under thermally stable non-windy conditions, models accurate to 3.5 mdeg can be obtained**
  - **The antennas drift from the models after a few days...they fit well at first but within a month the peak errors are 20 mdeg**
    - **This is large enough that monopulse would not work**
    - **Operational headache to get on point: X-conscan, then Ka-conscan, then monopulse**
      - **Does not work for radio sources**
  - **Azimuth track level errors are around 6 mdeg**

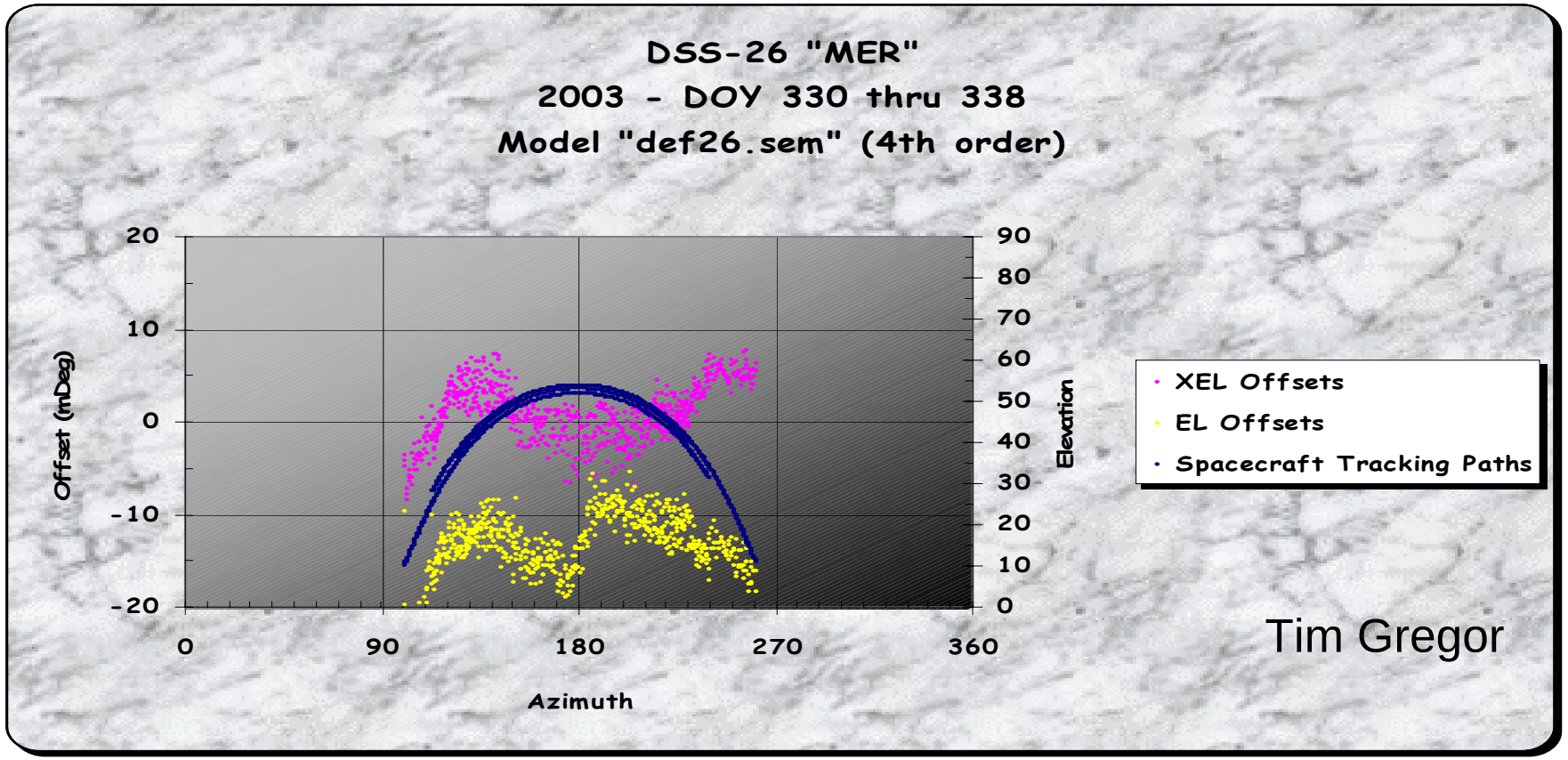
Sample Calibration Data

- Model was derived from all-sky radio source observation
- Voyager I Track on DOY 119, 2003
- MRE = 3.5-mdeg
- "One of the best blind pointing tracks we've seen"



Sample of Model Decay 1

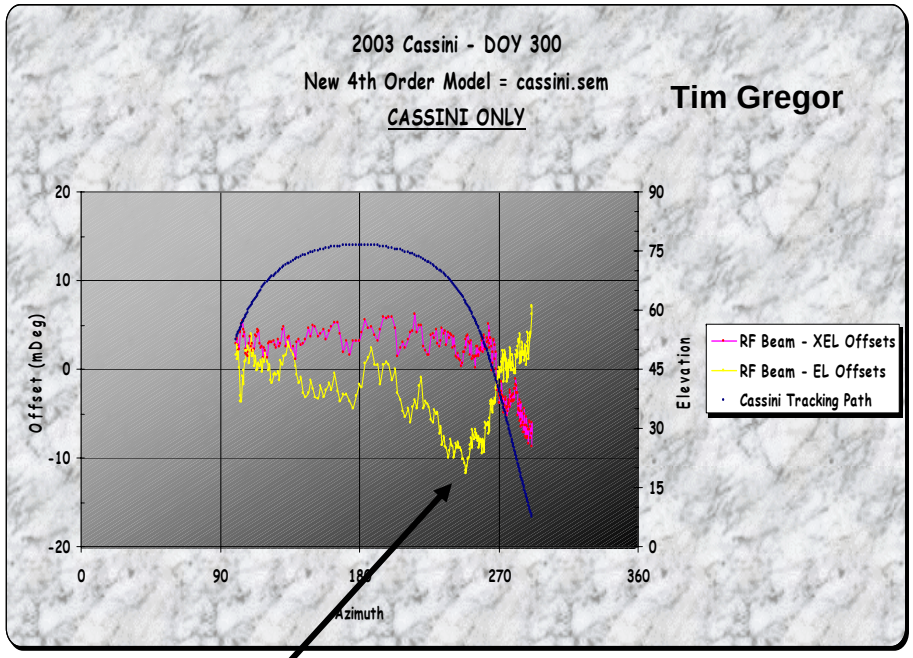
- DSS-26 Pointing performance on DOY 330, 2003
- Approximately 2.5 months after installation of model
- MRE = 13.5-mdeg, STDEV = 3.36-mdeg



Sample of Model Decay 2

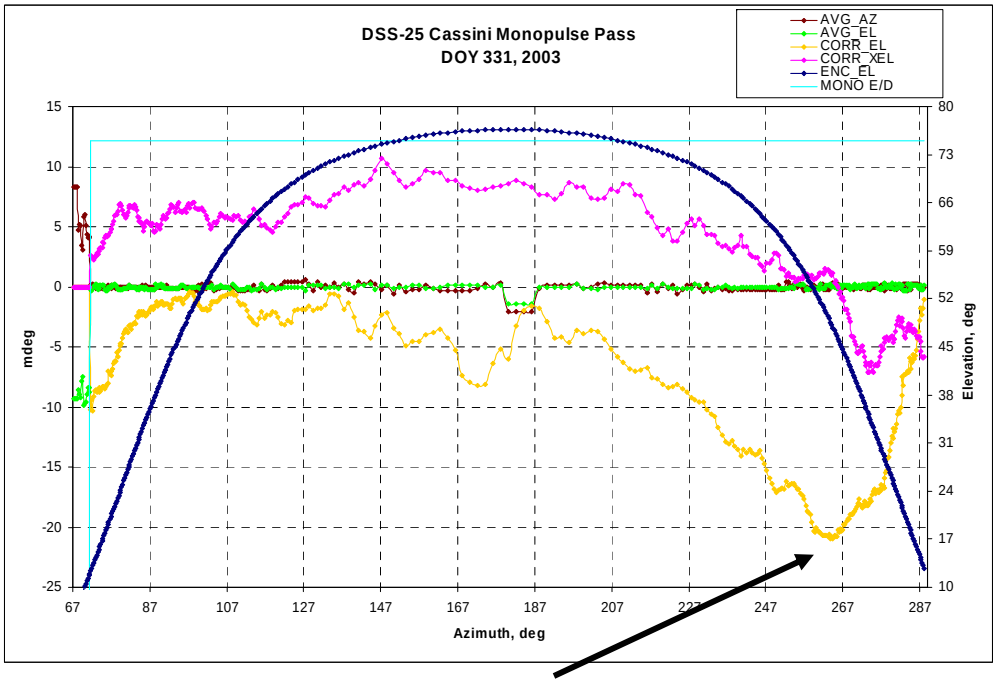
- DSS-25 Pointing performance on DOYs 330 vs. 331, 2003
- Approximately 1 month after installation of model

DOY 300



10-mdeg peak in EL

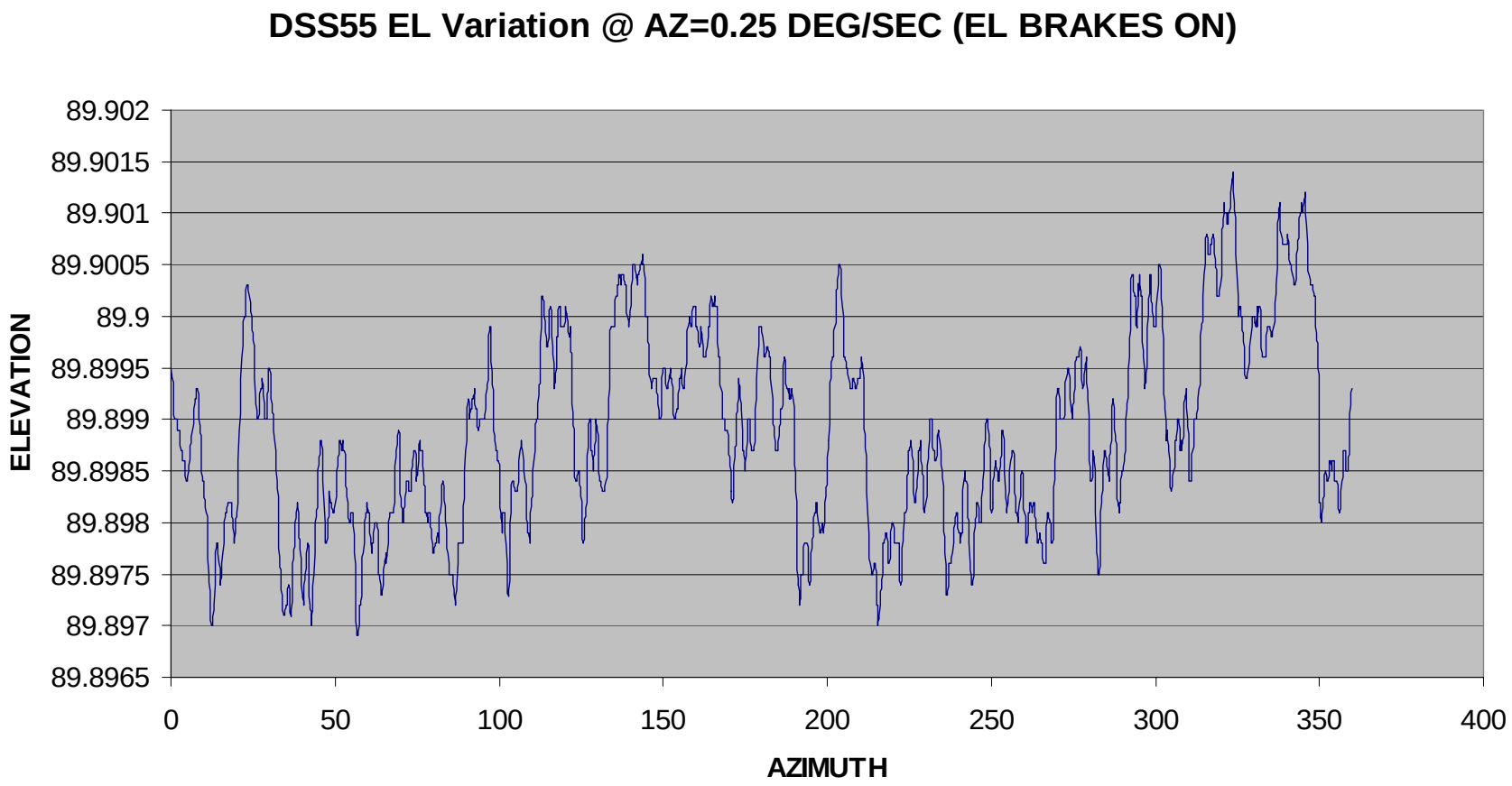
DOY 331



20-mdeg peak in EL

Azimuth Track Level Unevenness

- One set of measurements of azimuth track level unevenness at DSS-55 indicate +/- 2.1-mdeg errors
- Corresponding to 16 track segments



Azimuth Track Level Measured by Inclinometers

- **Experimental measurements by W. Gawronski**

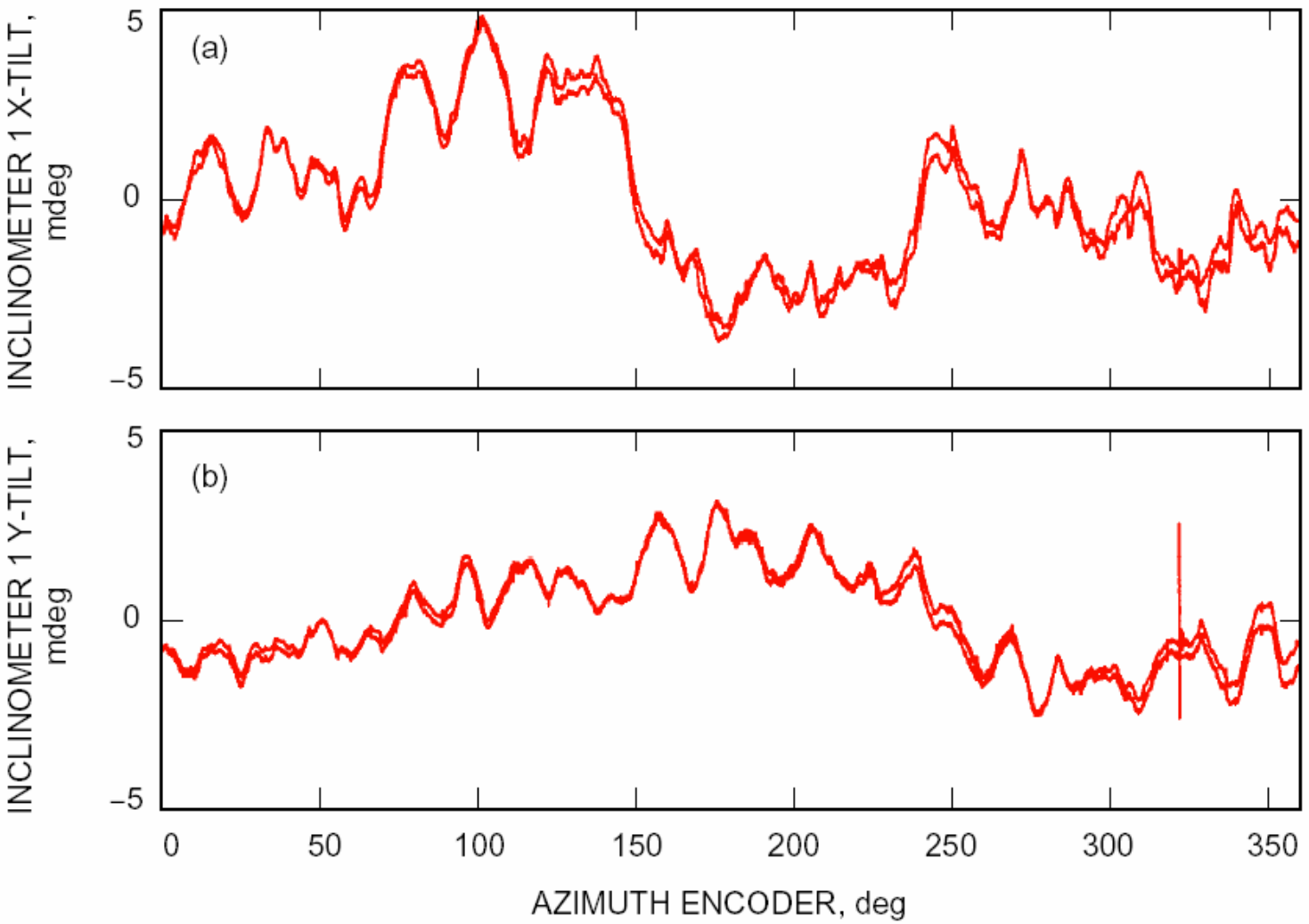


Fig. 3. Repeatability of inclinometer 1 readings: (a) x-tilt and (b) y-tilt.

What Goes Into Making a Good Pointing Calibration?

- Enough data all over the sky to fully measure the errors
  - Spacecraft tracking data can never be extrapolated to other parts of the sky
- Enough time to be able to select reliable data
  - Wind, sunrise/sunset, equipment problems invalidate the data
- Enough time to check the model
  - Despite the best effort, blunders do occur
- The right equipment and algorithms
  - Some of the older equipment uses slower data gathering procedures
  - Some of the older algorithms magnify errors in the data, or produce unstable answers
  - Azimuth track level instrumentation, receiver instrumentation, computers, software
- Knowledge, experience, and patience

Impact on Scheduling

- The previous plan for calibrating the antennas for pointing once per year is no longer credible
- The calibration period has to be reduced to something in the 2-4 weeks range
  - We don't have enough experience yet to know what will work the best
    - Option 1: monthly, one 12-hour track followed a few days later by a 5-hour track
    - Option 2: biweekly, one 8-hour track
    - A year of experience will be needed to find the best approach
  - Some flexibility in the timing is possible
    - Must avoid sunset/sunrise, wind, rain, failed equipment
- Drivers:
  - MRO Operational Ka-band Delta-DOR demonstration
    - Radio source catalog needs > 1 year of preparation
    - Already risking the MRO cruise plan for delta-DOR tests late 2005
  - Cassini occulations (Feb, May-Aug 2005)
  - MRO Operational Ka-band telemetry tests Aug 2005
- Applies to all 34m BWG antennas

Deep Impact Launch Status

Joint Users Resource Allocation & Planning (JURAP)

November 18, 2004

Deep Risk Review Status

Launch Vehicle Readiness Review (LVRR)	30-Nov-04 - KSC
DSMS Mission Event Readiness Review (MERR)	30-Nov-04 - JPL
Integrated Mission Assurance Review (IMAR)	2-Dec-04 - NASA HQ(Telecon)
Mission Readiness Review (MRR)	3-Dec-04 - JPL/KSC
JPL GMPC (MRR)	4-Dec-04 JPL/KSC
Mission Readiness Briefing To Code S	9-Dec-04 NASA HQ
Launch Site Readiness Review (LSRR)	16-Dec-04 - KSC
Flight Readiness Review (FRR)	27-Dec-04 - KSC
Launch Management Coordination Meeting	28-Dec-04 - KSC
Mission Dress Rehearsal (MDR)	28-Dec-04 - All Locations
Launch Readiness Review (LRR)	29-Dec-04 - KSC

ORT Schedule

- Jul. 13, 2004 — ORT-1: Launch (Nominal)
  - Countdown through initial acquisition
- Aug. 3-20, 2004 — ORT-2: TCM (Nominal)*
  - TCM design, implementation, and reconstruction
- Sept. 1-2, 2004 — MRT: Flight System Encounter w/ Ops Participation
  - Impactor release, divert maneuver, final imaging, impact, shield mode
- Sept. 29-30, 2004 — MRT: Flight System Encounter w/ Ops Participation
- Oct. 19-20, 2004 — ORT-3: Launch (Nominal) - DELETED
  - Countdown through initial acquisition, go to point
- ◊ Oct. 26, 2004 — Operations Readiness Review
- Oct. 27- Nov 5, 2004 — ORT-4: TCM (Nominal)*
- Nov. 15-16, 2004 — ORT-5: Launch (On S/C, Nominal)*
- Dec. 6-10, 2004 — ORT-6: Launch thru L+3, L+9 (5 days)
  - Launch w/ contingencies, Quick alignment, Moon imaging, Autonav demo
  - DSN participation for Launch
- Dec. 14-15, 2004 — ORT-7: Launch (w/ contingencies)*
- Dec. 20, 2004 — ORT Placeholder
- ◊ Dec. 28, 2004 — Launch Dress Rehearsal
- ◊ Dec. 30, 2004 — Launch

* Incompressible Test

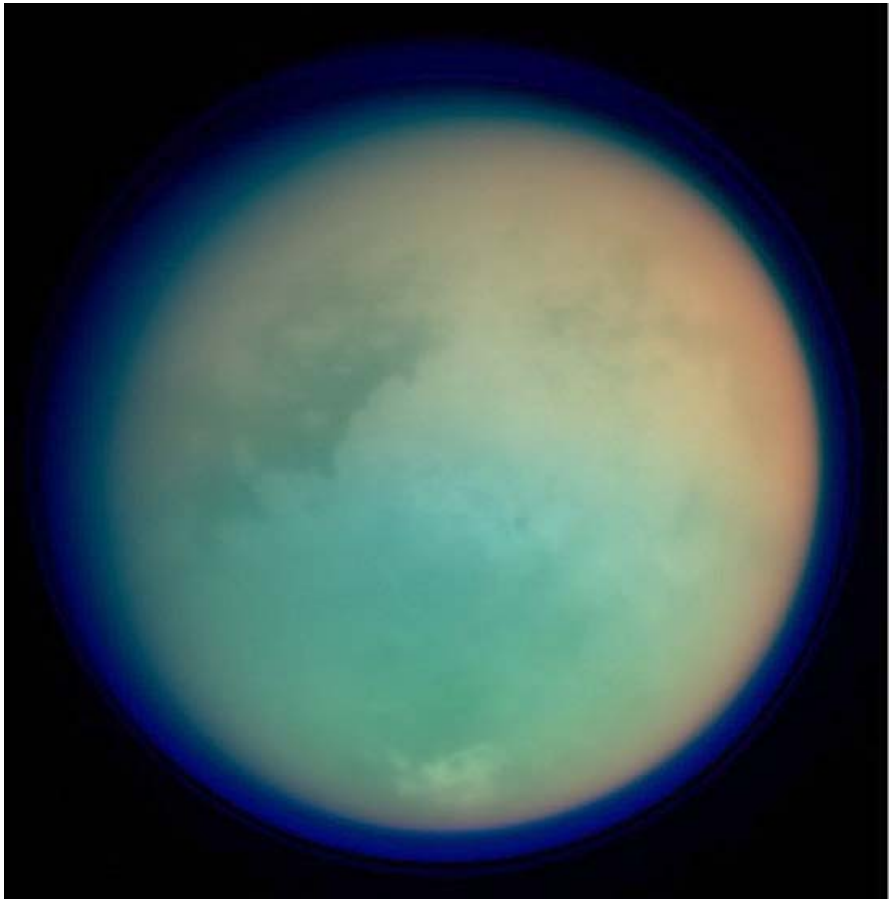
Deep Impact Launch Status

- Primary Launch Window
  - 30 Dec 2004 - 19 Jan 2005
- Secondary Launch Window
  - 20 - 28 January
- 2 Instantaneous opportunities per day
  - 095° and 101° Azimuths
  - (Δt = 39-40 min)
  - Same DSN coverage for both opportunities each day.
- Go for 1st opportunity (30 Dec)

Questions / Comments

Cassini / Huygens

- **Operating in Saturn Orbital Tour**
  - Iapetus Distant (>1 million km) Flyby October 16 through 19
    - DSN Level-2 support was nominal
    - Doppler collected for characterizing Iapetus' mass for Huygens release planning
  - Titan-A Flyby October 26 at 1200 km altitude
    - All observations and operations were nominal



TITAN IMAGE Constructed from four images ISS acquired October 26, 2004 through different color filters. Red and green represent infrared wavelengths and show areas where atmospheric methane absorbs light revealing a brighter (redder) northern hemisphere. Blue represents ultraviolet wavelengths and shows the high atmosphere and detached hazes.

Titan has a gigantic atmosphere, extending hundreds of kilometers above the surface. Surface pressure is greater than that at Earth's surface.

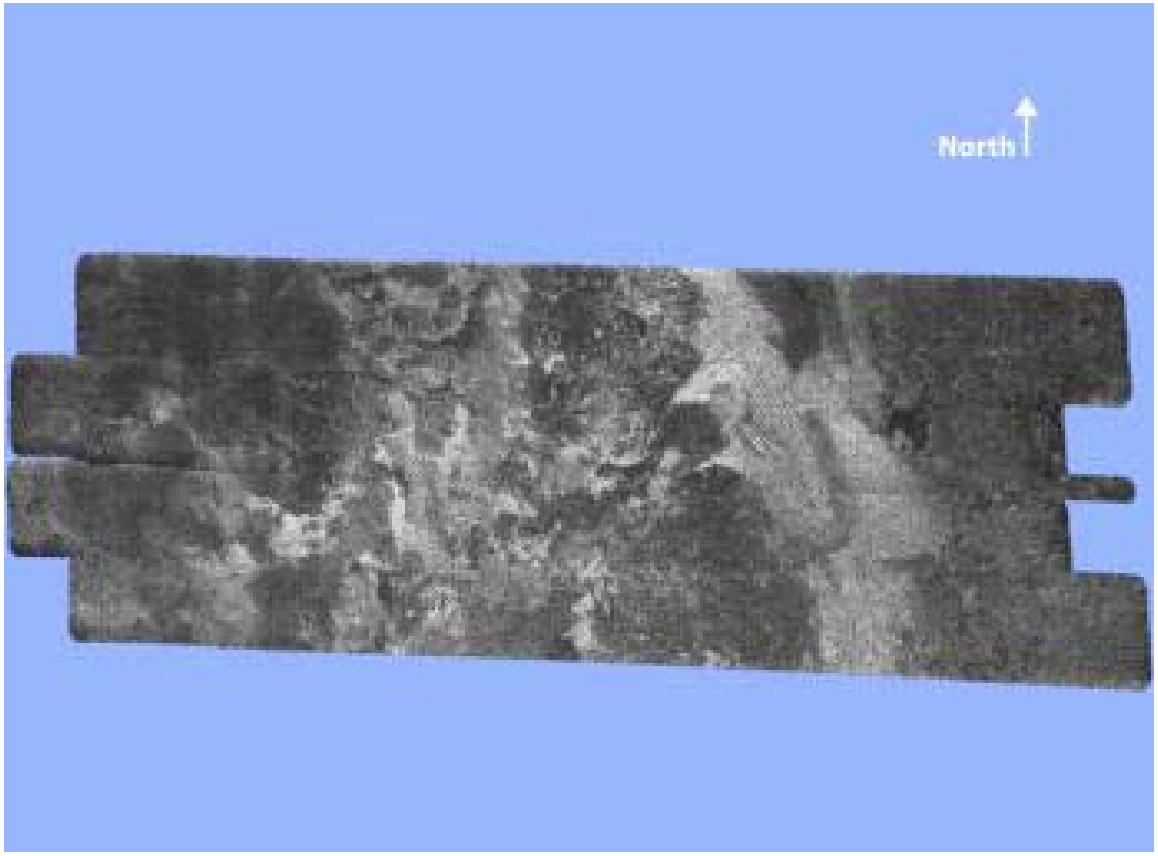
The sharp variations in brightness on Titan's surface (and clouds near the south pole) are apparent at infrared wavelengths. The image scale of this picture is 6.4 kilometers per pixel.

Cassini / Huygens

FIRST TITAN SYNTHETIC APERTURE RADAR IMAGE acquired October 26 reveals a complex geologic surface thought to be composed of icy materials and hydrocarbons.

A wide variety of terrain types can be seen; brighter areas may correspond to rougher terrains and darker areas are thought to be smoother. A large dark circular feature is seen at the western (left) end, but very few features resembling fresh impact craters are seen. This suggests that the surface is relatively young. Enigmatic sinuous bright linear features are visible, mainly cutting across dark areas.

The image is about 150 km wide and 250 km long, centered at 50 N, 82 W, over a region not yet imaged optically. The smallest details are about 300 meters across.



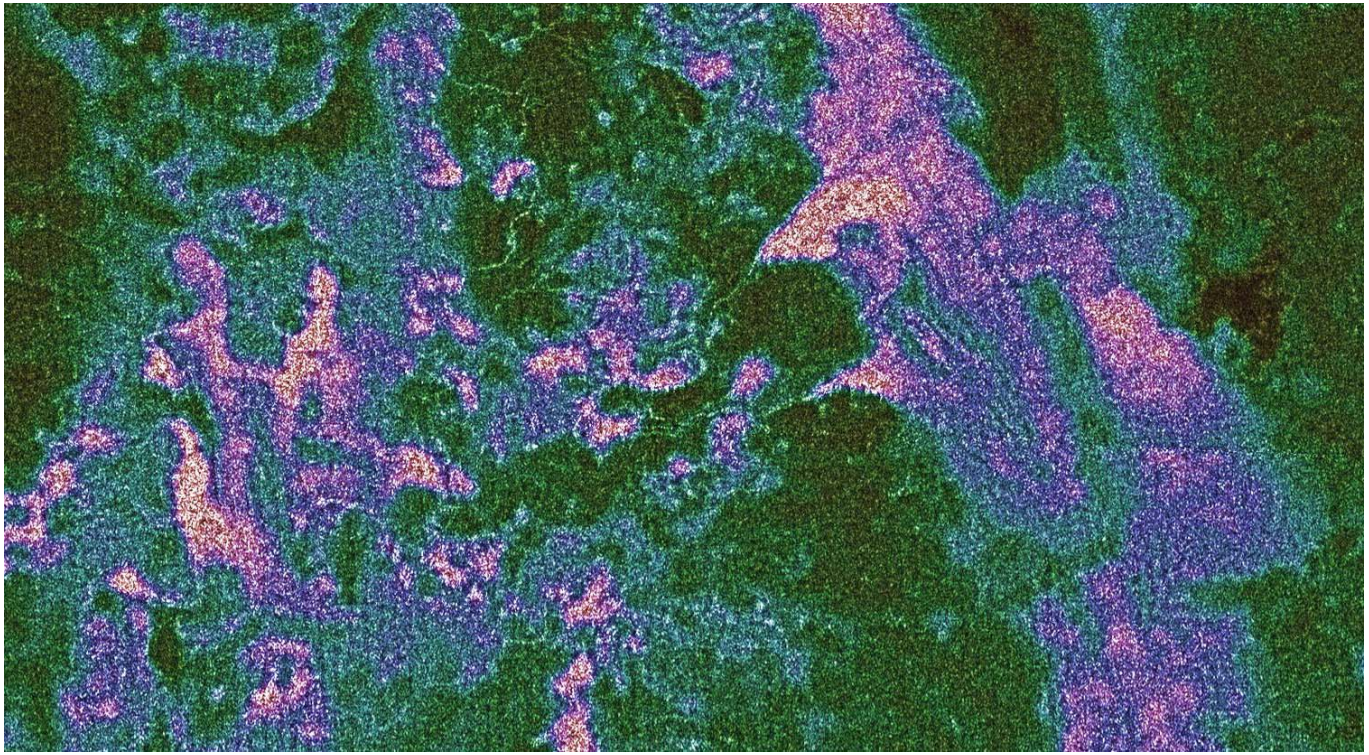
Cassini / Huygens

Excerpts from interview with Ralph Lorenz, UofA Lunar and Planetary Laboratory, by Astrobiology Magazine editor Leslie Mullen:

“The features we've seen with RADAR include one large, pancake-shaped dome. We've seen features like that on the planet Venus… There's another feature on Titan that looks like something has flowed across the surface. It's branched and lobate, like a lava flow.

“There could be all sorts of explanations for both of these features, but in this first look at Titan, seeing these is quite interesting.

“On Titan, if we have cryovolcanic lava flows of liquid water interacting with this organic stuff that rains out of the atmosphere, it could take thousands of years to freeze solid. As it freezes, it progressively concentrates the stuff that's dissolved in it, and makes an interesting experiment in pre-biotic chemistry.”



TITAN SYNTHETIC APERTURE RADAR IMAGE

Cassini / Huygens

Excerpt from *New Scientist,* November 2, 2004:

"In Greek mythology, Prometheus stole fire from the Gods. Now, Saturn's tiny moon Prometheus is showing similar tendencies, repeatedly stealing material from planet's rings.

"The crescent moon Prometheus is pulling material from Saturn's F Ring.

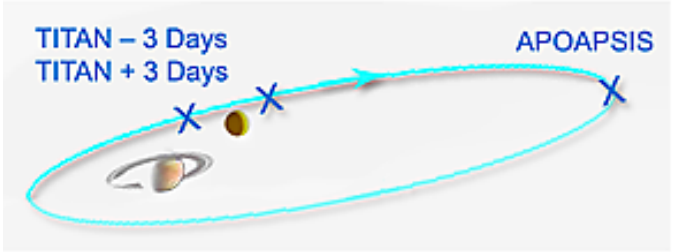
"The image was taken on 29 October 2004 from a distance of 791,000 km. It shows a… partially illuminated, potato-shaped moon Prometheus, which is about 150 km in length...

"This image confirms that sometimes Prometheus strips material from its neighbouring ring, as a stream of material appears to be drawn from the innermost bright strand toward the moon."

PROMETHEUS AT ITS CLOSEST APPROACH TO THE F RING

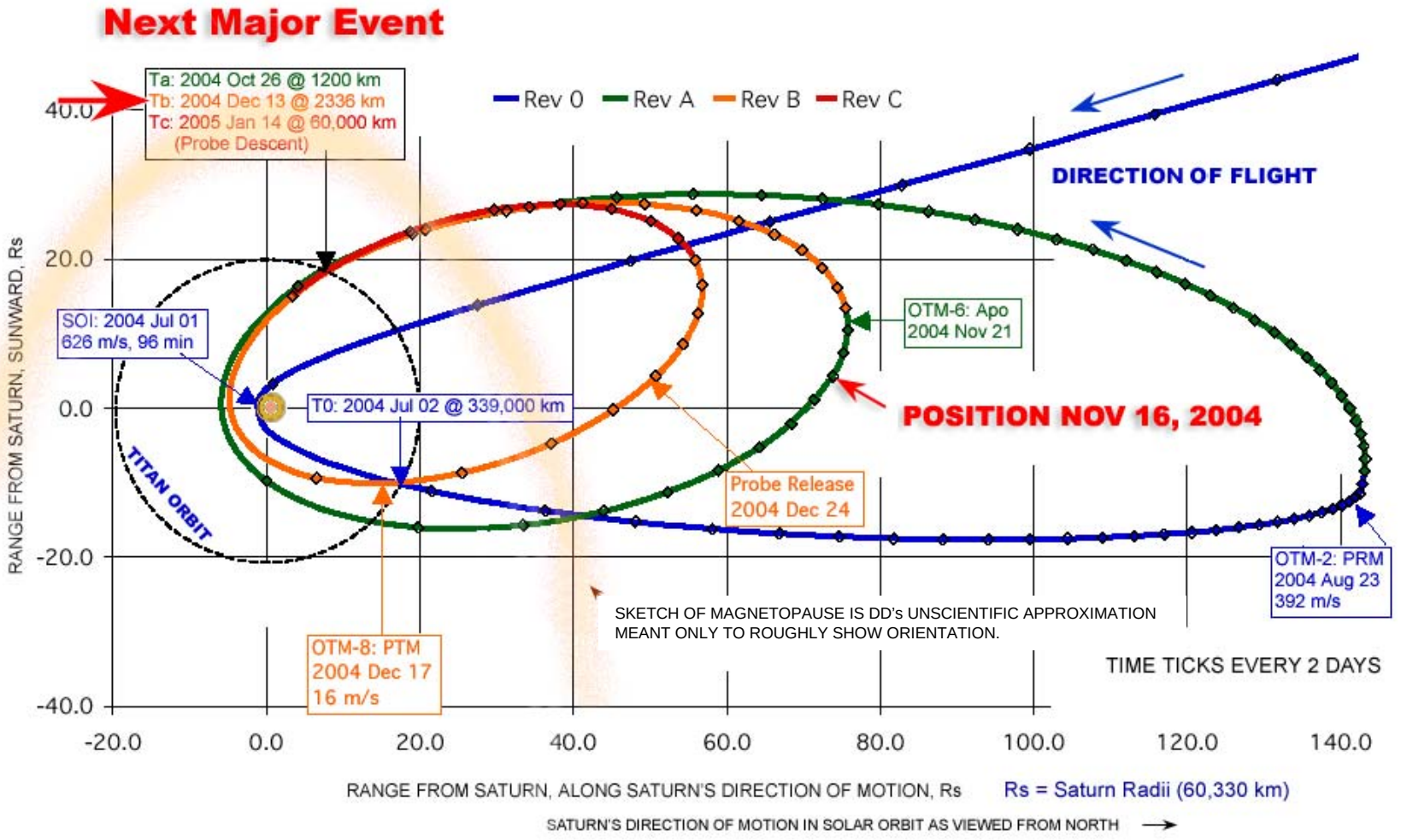
Cassini / Huygens

- **Next Major Events**
  - OTM-6 at apoapsis Saturday night November 20 PST
  - All OTMs scheduled for DSN Level-2 Support
    - Backup OTMS also L-2, but reduced to L-3 after prime OTM nominal execution
  - Huygens final Battery Depassivation December 5
  - Titan-B Flyby December 13 at 2336 km altitude
  - Huygens Release December 24 PST (December 25 UTC)
    - This may vary by a couple of days, TBD.
  - Huygens Mission January 14, 2005
    - Playback of Huygens data from Cassini 2005 DOY 014/015



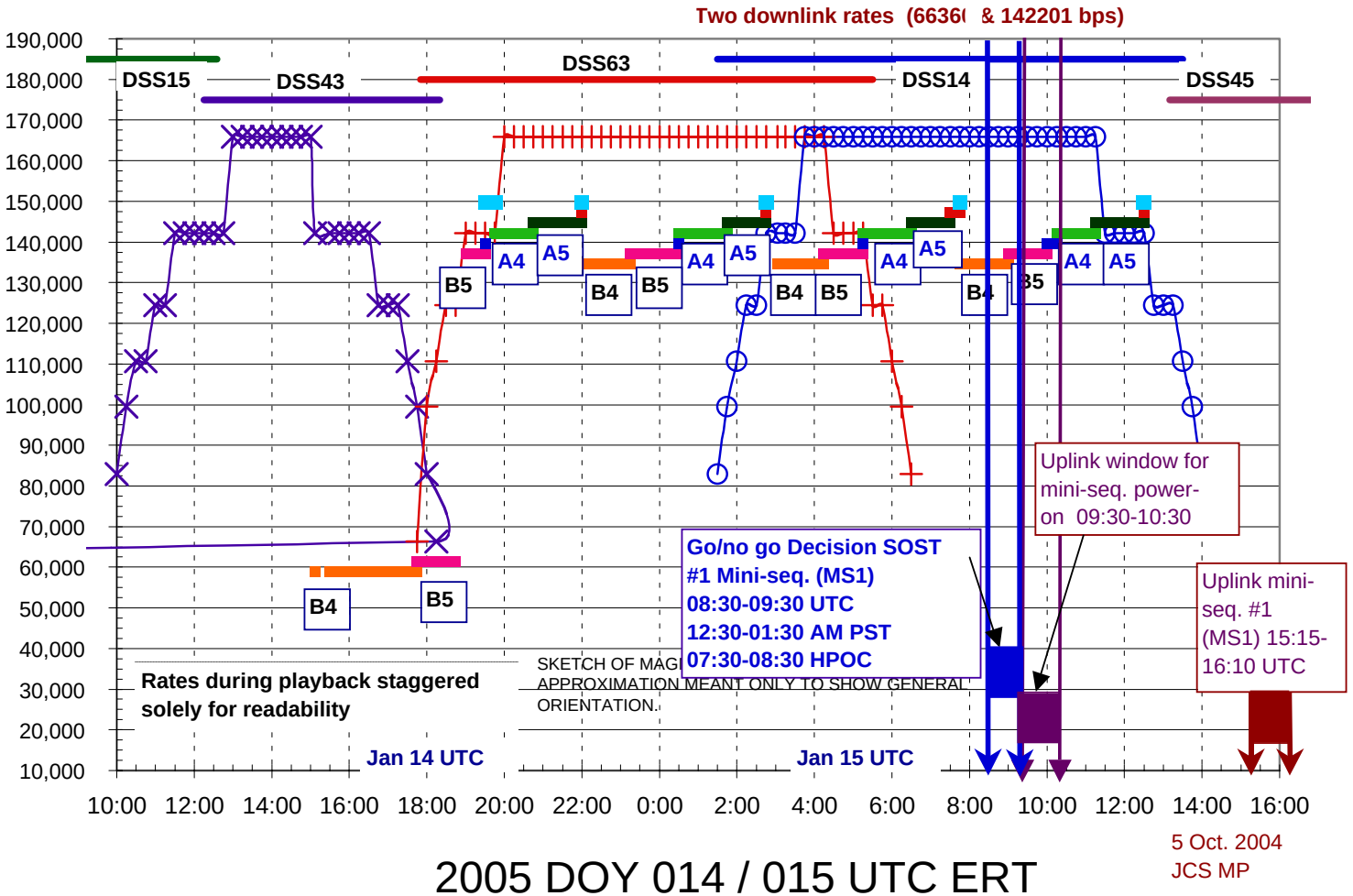
THREE OTMs EVERY SATURN ORBIT

Cassini / Huygens



Cassini / Huygens

Strategy for Huygens Data Playback from Cassini



2005 DOY 014 / 015 UTC ERT

30-MIN TIME TICKS

Cassini / Huygens

Editing note: Movies and an animation follow.

Delete this and subsequent pages from publication (unless web/electronic publication can permit viewing movies and animations).

Cassini / Huygens

Movie of Titan from images obtained during T-0 flyby at a range of 339,000 km.

There is one small white cloud visible near the south pole. All other features are on Titan's surface.

QuickTime™ and a GIF decompressor are needed to see this picture.

Cassini / Huygens

Animation of Cassini Spacecraft activities during Titan flyby “T-A” October 26, 2004, shows optical instrument and RADAR fields of view. Closest Approach altitude 1200 km above Titan’s surface.

QuickTime™ and a PNG decompressor are needed to see this picture.

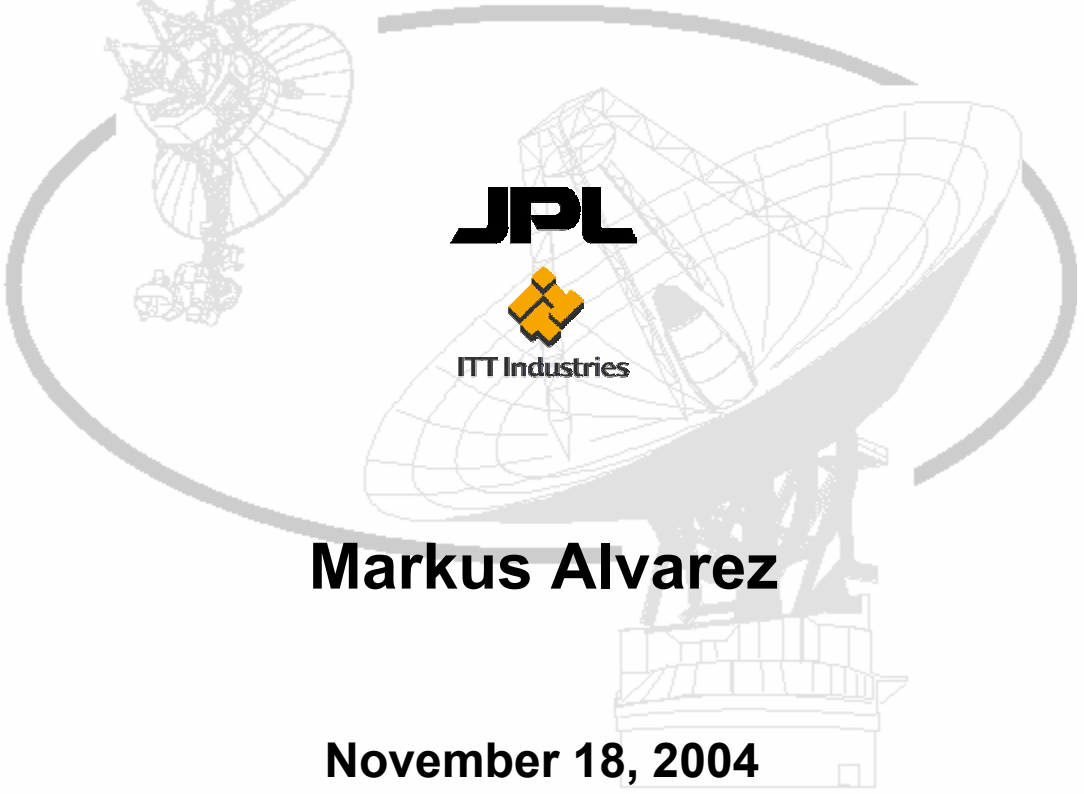
Cassini / Huygens

Movie made from ISS images taken during Titan flyby “T-A” October 26, 2004, shows surface features and the cloud near south pole. Closest Approach altitude 1200 km above Titan’s surface.

QuickTime™ and a GIF decompressor are needed to see this picture.

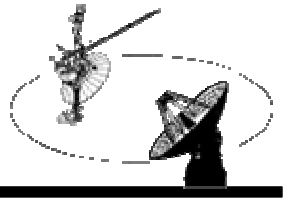
Interplanetary Network Directorate

Ground Communications Preventive Maintenance



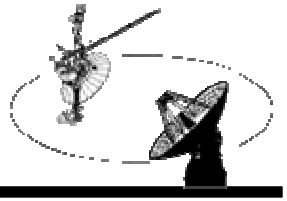
Markus Alvarez

November 18, 2004



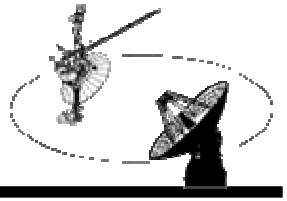
Agenda

- Introduction
- Overview
- Areas of responsibilities
- Objectives
- Schedules
- Risks / Impacts
- Justification
- Physical Diagram



Introduction

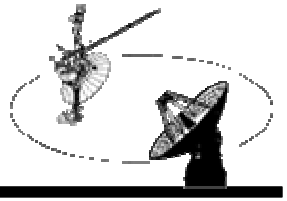
- ITT Operations and Maintenance Contract
  - DSN Operations Engineer for Ground Communications
    - Markus Alvarez
      - Responsible for sustaining form, fit and function of current DSN Ground Communications.
- JPL Communications and IT Services
  - DSN Network Implementation Cognizant Design Engineer
    - Michael Rafferty
      - Responsible for design, deployment and implementations for DSN Ground Communication assemblies.
  - DSN Ground System Engineer
    - Jay Holladay
      - Responsible for identifying Communications and Mission data flow requirements.



Overview

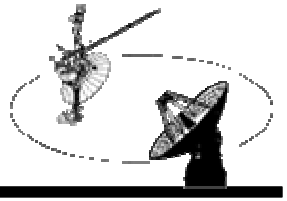
- The DSN Ground Communication community requests a scheduled 1 hour maintenance period per month for the CCT, and for each complex (SPC-10, 40 and 60).

- The purpose of this request is to perform preventive maintenance activities to minimize equipment failure during an active mission support.



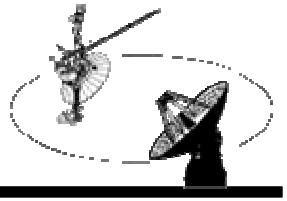
Areas of Responsibilities

- Identified in 820-61 DSMS Subsystem, Configuration and Responsibility Assignments Document. Document is located: http://dsnjplonline.jpl.nasa.gov/ecmweb/82061.htm
  - DSN
    - Ground Transmission Subsystem (GTX)
    - T-1 Communication Circuits
    - Operational Voice Subsystem (OVS)
    - Cisco Switches (DLS)
    - Cisco Routers (GCR)
    - Ground Network Monitoring (GNM)



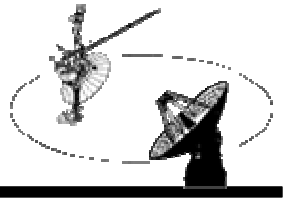
Objectives

- Be able to provide routine preventive maintenance activities
  - Reset Routers and Switches
  - Repair/Swap Routers and Switches
  - Repair/Swap Comm boards on Station Voice Switch
  - Install software patches/firmware updates
  - Comm Circuit Swaps
  - RNS Space Craft reconfiguration



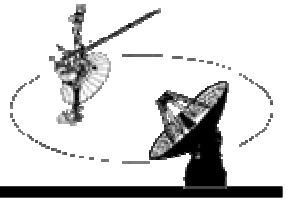
Schedules

- **Proposed schedules have been submitted to DSN-RAP:**
  - **One hour**
  - **Per month**
  - **Per each complex (CCT, SPC-10, 40 and 60)**
  - **Tuesday and/or Wednesdays for CCT, SPC-10, 40 and 60**
  - **Thursdays for CCT, SPC-10 and SPC-60**
  - **During JPL local hours**
  - **No Friday changes!**



Risks and Impacts

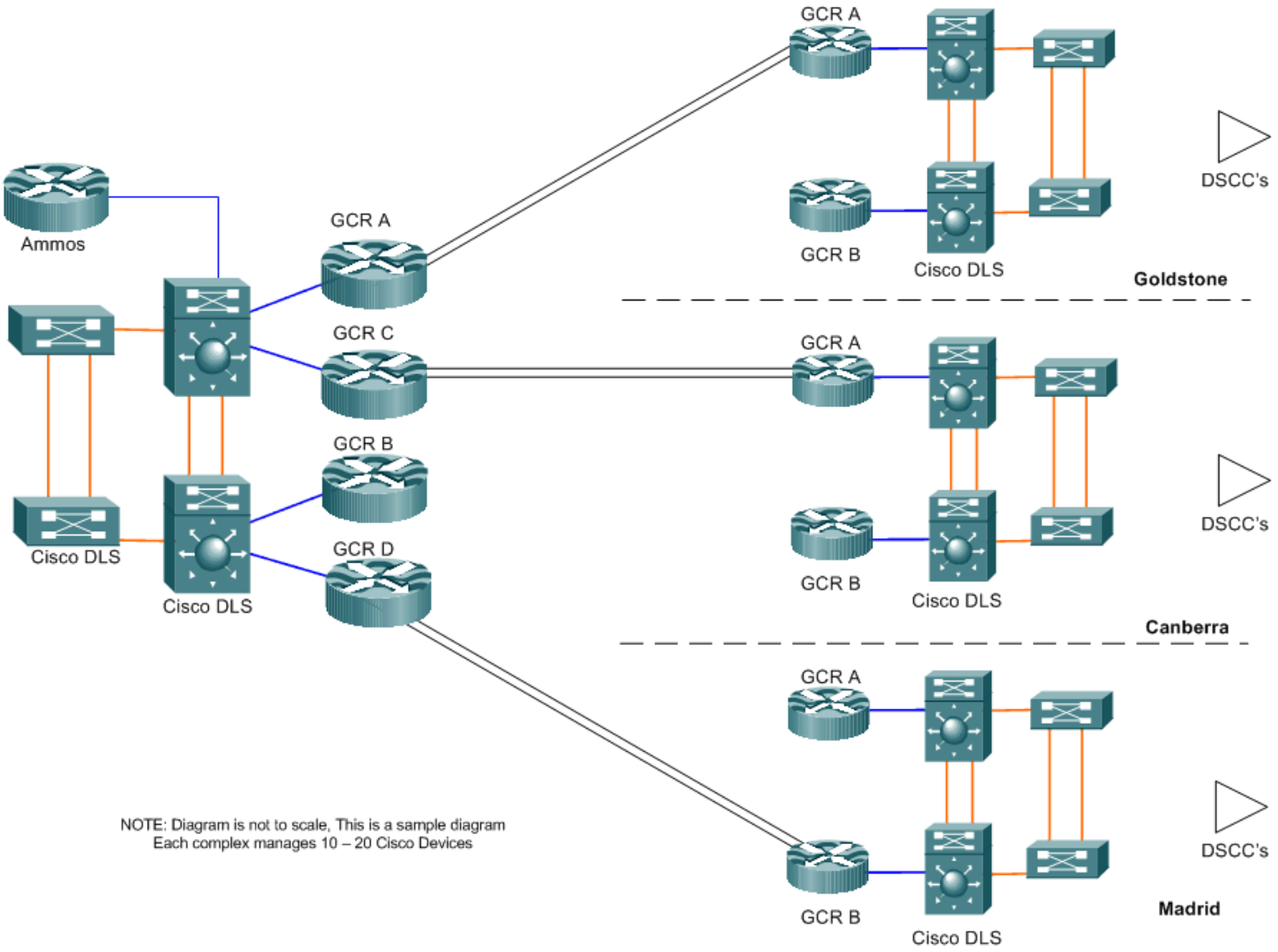
- Do not need true “Global Downtime”
- Stations can continue to track and receive data
- Tracking and Telemetry are stored and forwarded through RNS
- External activities can go NIB to our activities
- Maintenance activities may affect Commanding and NMC Real-time monitoring.



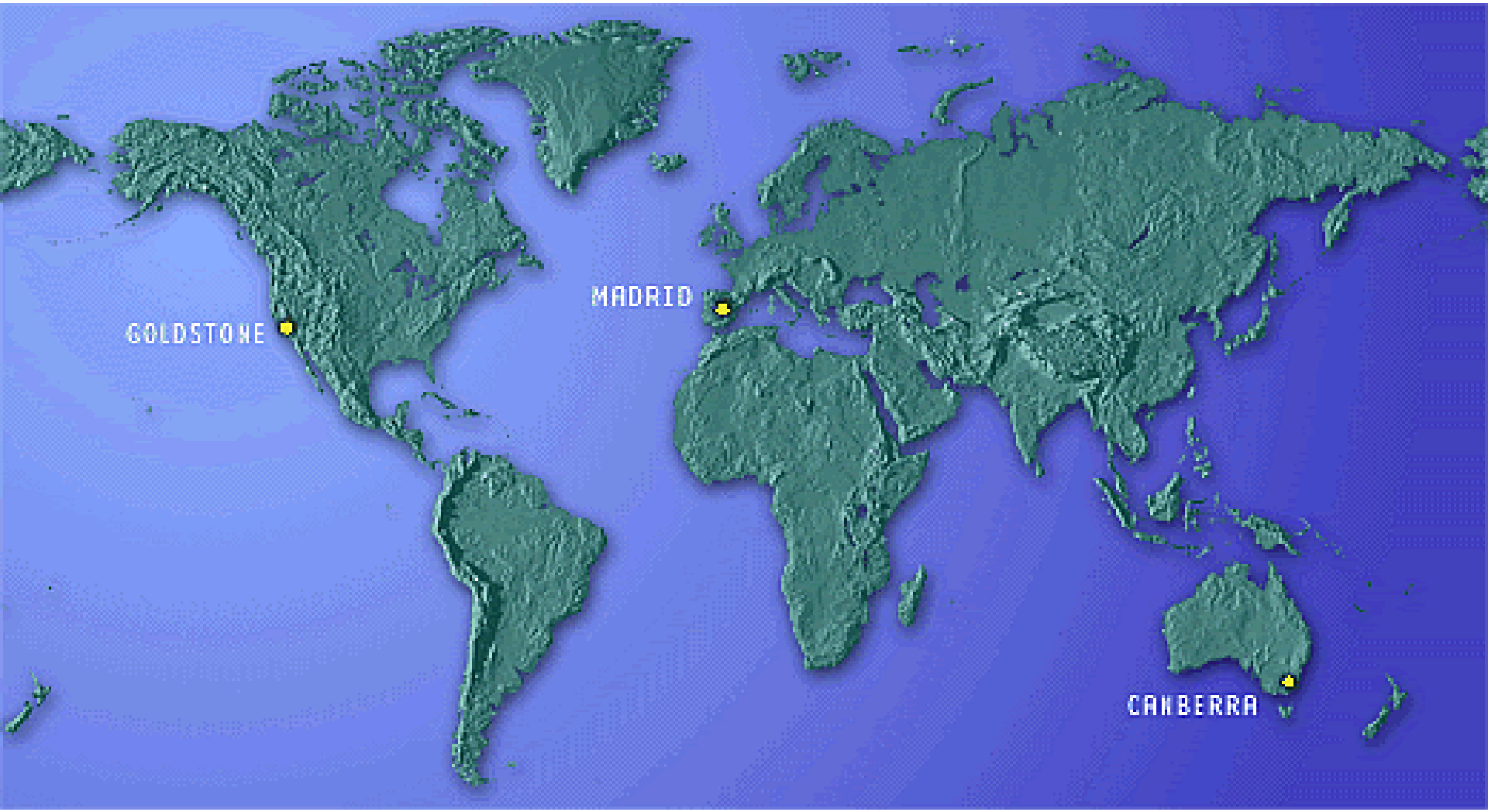
Justification

- Meet NASA security standards
- Repair damaged equipment
- Test faulty equipment
- Prevent failures during Level 1 critical support
- Update table configurations to meet mission requirements
- Maintain form, fit and function of operational equipment

DSN Comm. Diagram



DSN Antenna Downtime Status and Forecast



http://rapweb.jpl.nasa.gov/planning

Antenna Downtime Status and Forecast

Changes to 2004 Downtime Schedule

- It has been requested of Mid-Range scheduling to schedule Antenna Painting for Canberra Antennas, a plan has been developed to support these activities:
  - DSS-45 – Will be completed during current Downtime
  - DSS-43 – Will be done during 2005 Downtime already planned
  - DSS-34 – Will be done during 2005 Downtime already planned
  - DSS-46 – Has been scheduled to occur during Week 51, DOY 350 – 352 of 2004

- It was requested of DSN scheduling to schedule Antenna Painting for DSS-55. The priority of this task was increased and the task was scheduled in week 44 DOY 299 – 304. The activity was completed successfully.

- It was requested of DSN scheduling to schedule Jacking Pad installation at DSS-65 in preparation of the downtime tasks planned in February 2005. Schedulers have allocated Week 46, DOY 314 – 319. The activity was completed successfully.

- It has been requested of DSN scheduling to schedule a 4-day downtime to install and RMH Pumps at DSS16. The time has been successfully allocated to occur DOY 349/1600z to 353/1600z.

All previous requests have been negotiated and approved through the RARB, JURAP or Mid-Range Scheduling processes.

Antenna Downtime Status and Forecast

Changes to 2005 Downtime Schedule

- Due to budget constraints the DSS-27 NSP task scheduled in weeks 01 - 04 of 2005 has been cancelled. However the USC task that was scheduled NIB to the NSP task in weeks 02 and 03 are now a prime downtime and will occur as scheduled.

Changes to 2006 Downtime Schedule

- There are no outstanding downtime requests for 2006.

Changes to 2007 Downtime Schedule

- There are no outstanding downtime requests for 2007.

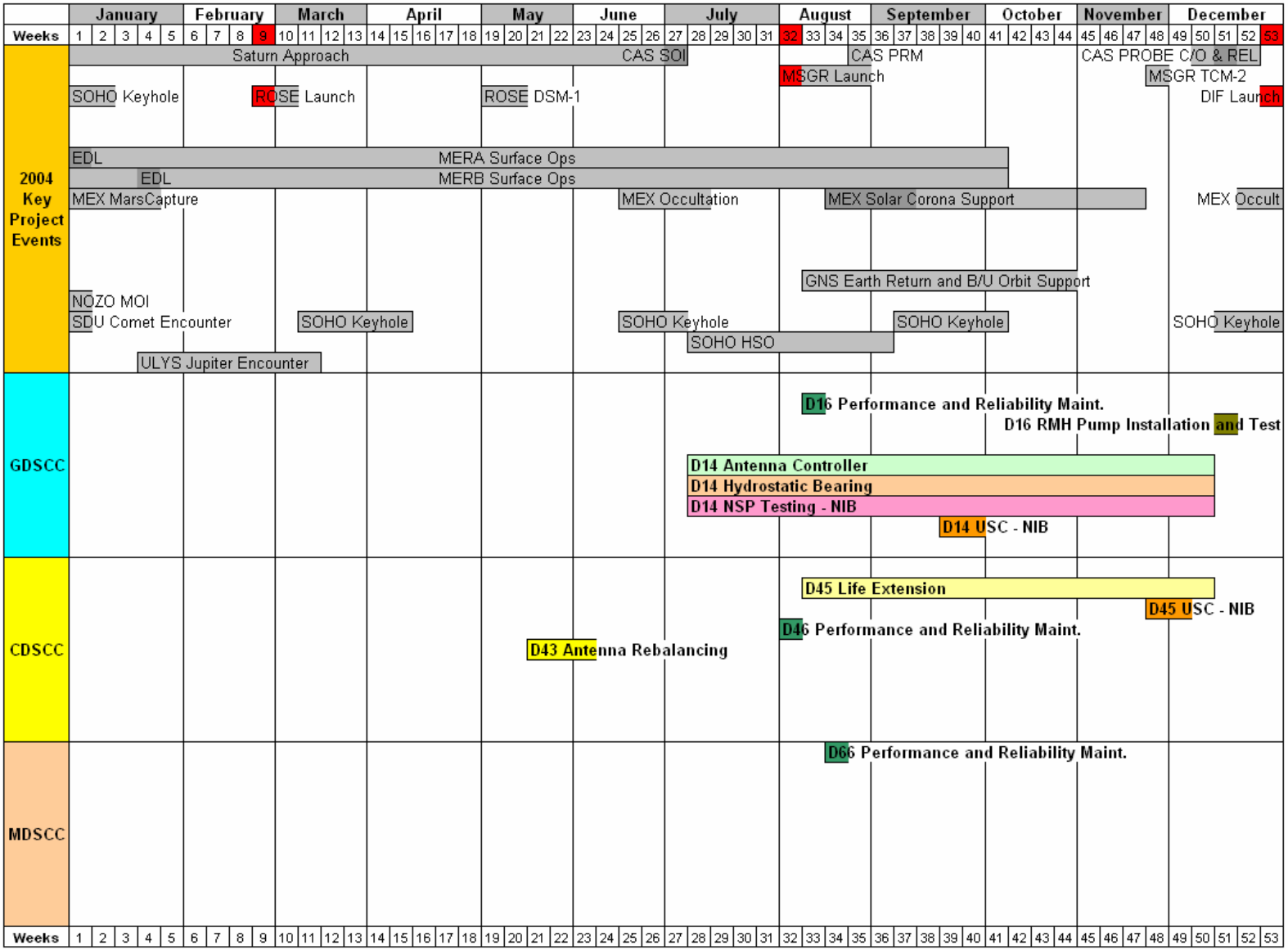
Changes to 2008 Downtime Schedule

- There are no outstanding downtime requests for 2008.

Changes to 2009 Downtime Schedule

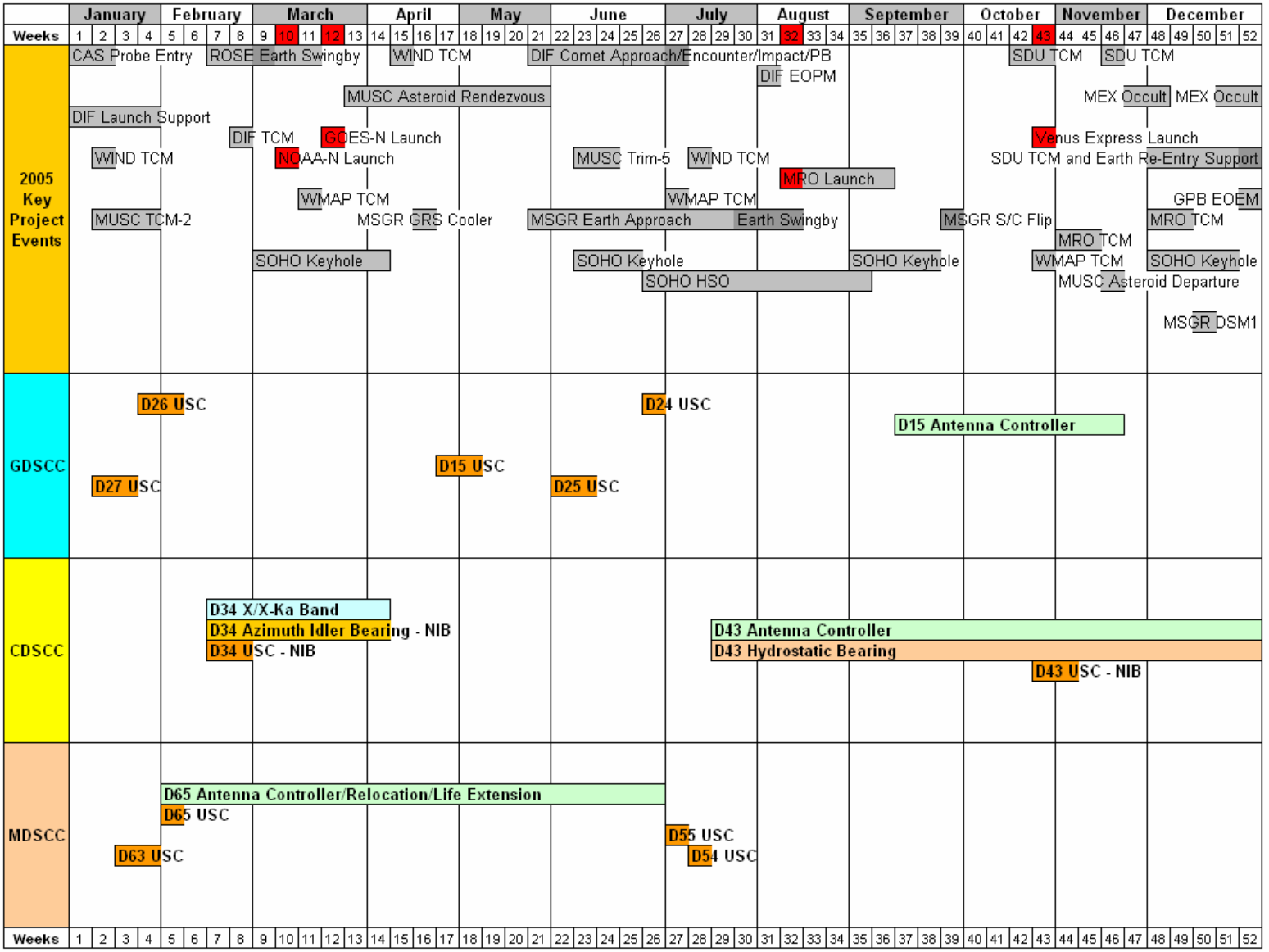
- There are no outstanding downtime requests for 2009.

Antenna Downtime Status And Forecast 2004



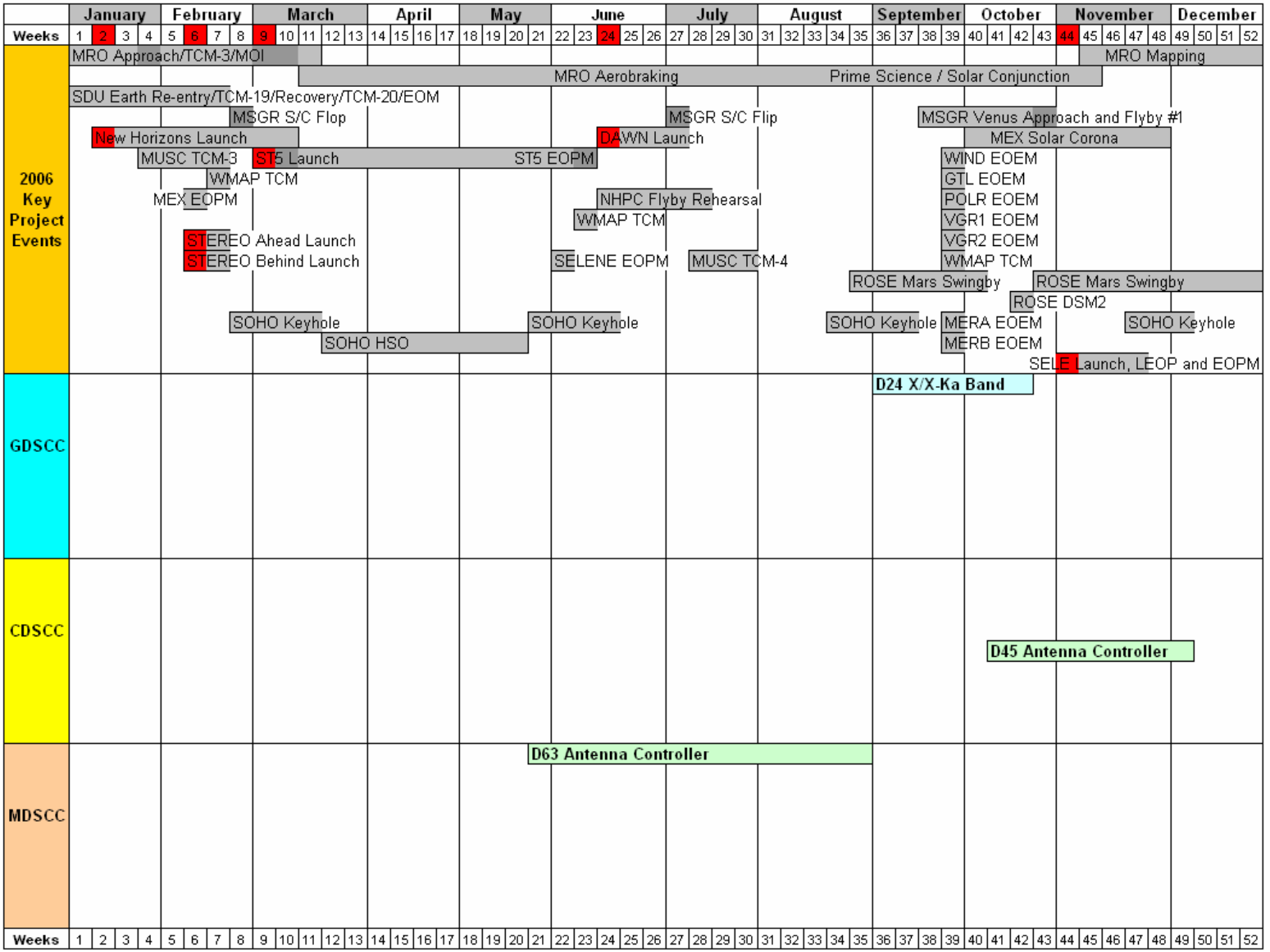
Revised: November 17, 2004

Antenna Downtime Status And Forecast 2005



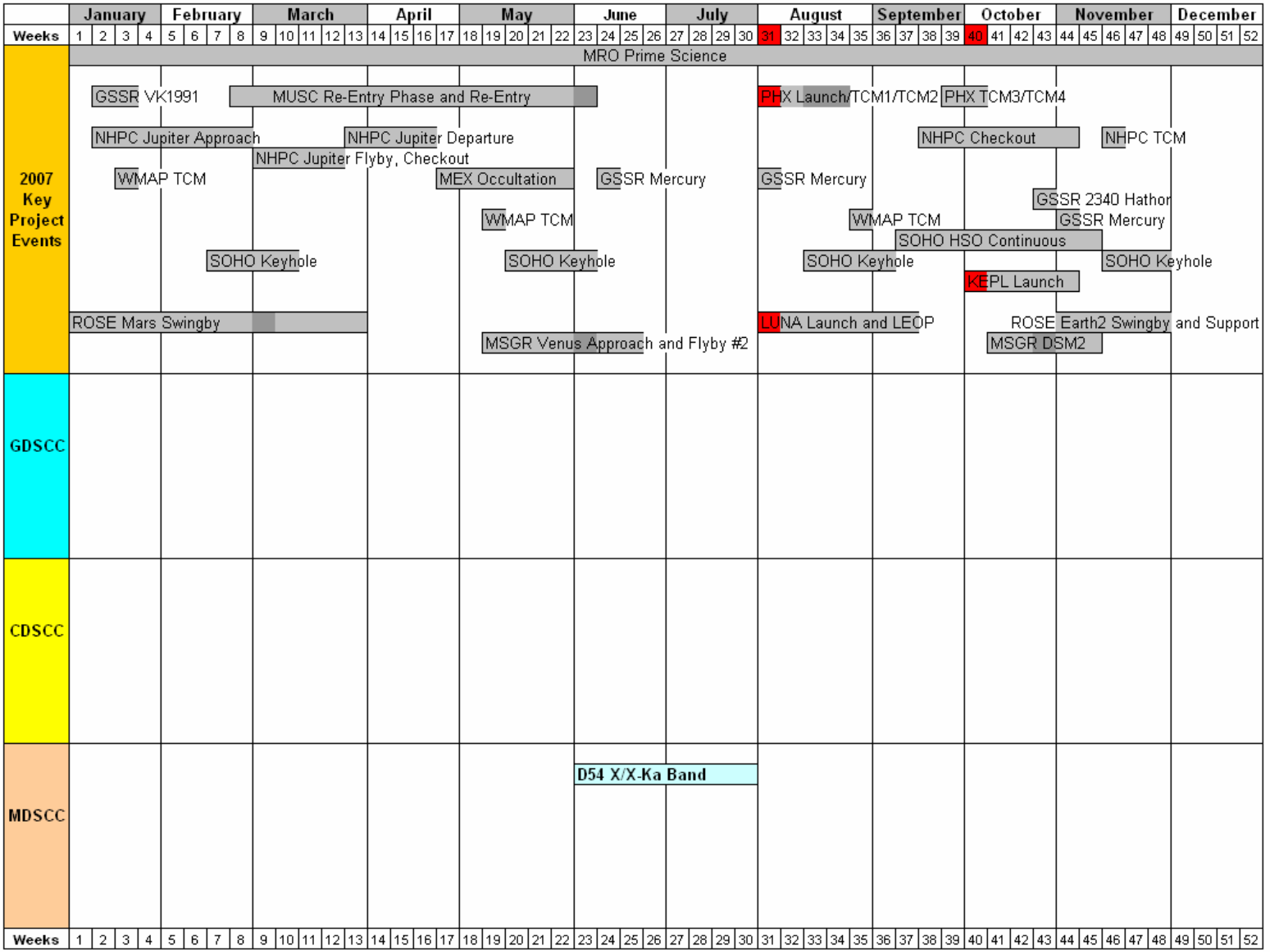
Revised: November 18, 2004

Antenna Downtime Status And Forecast 2006



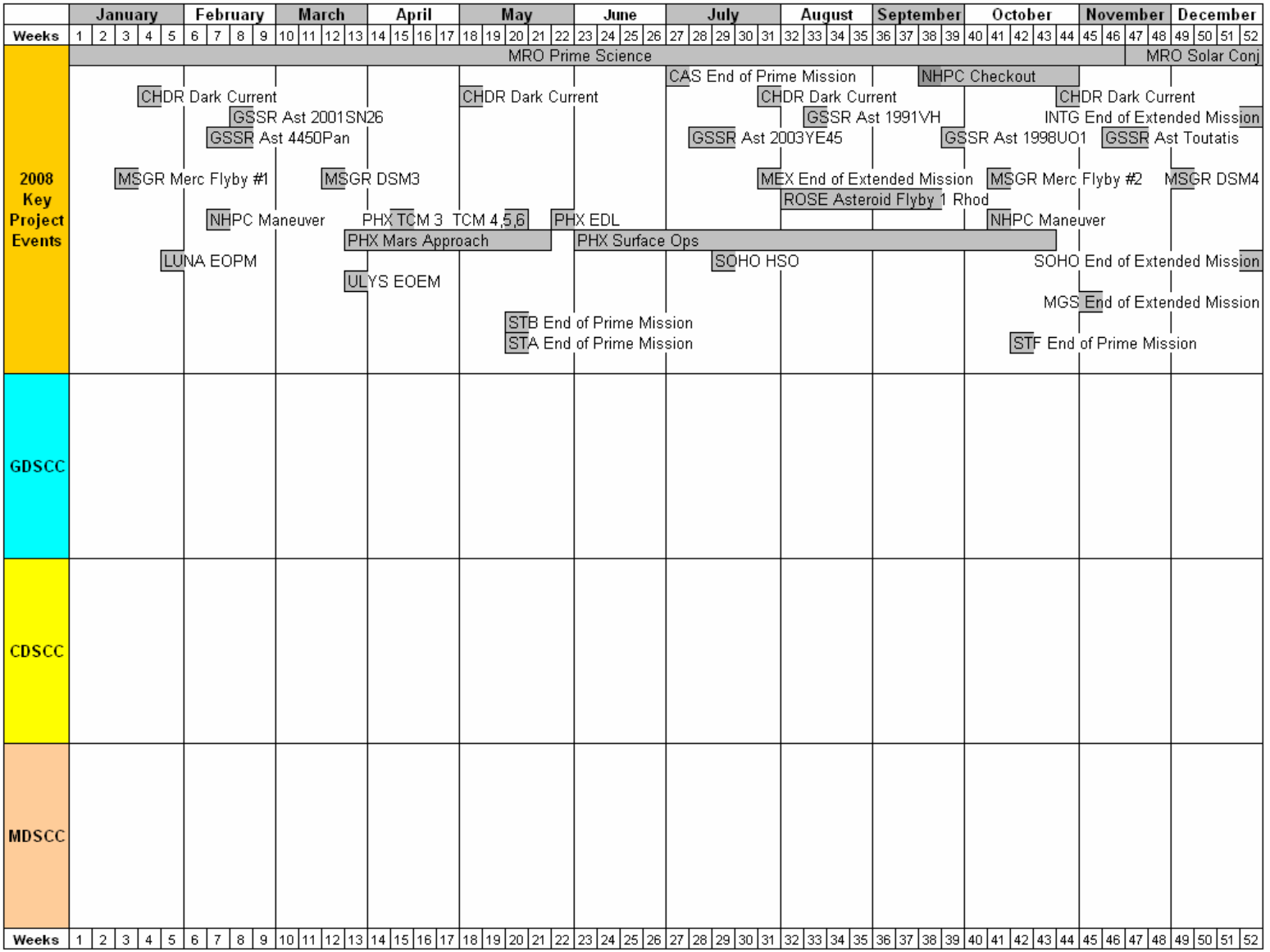
Revised: November 17, 2004

Antenna Downtime Status And Forecast 2007



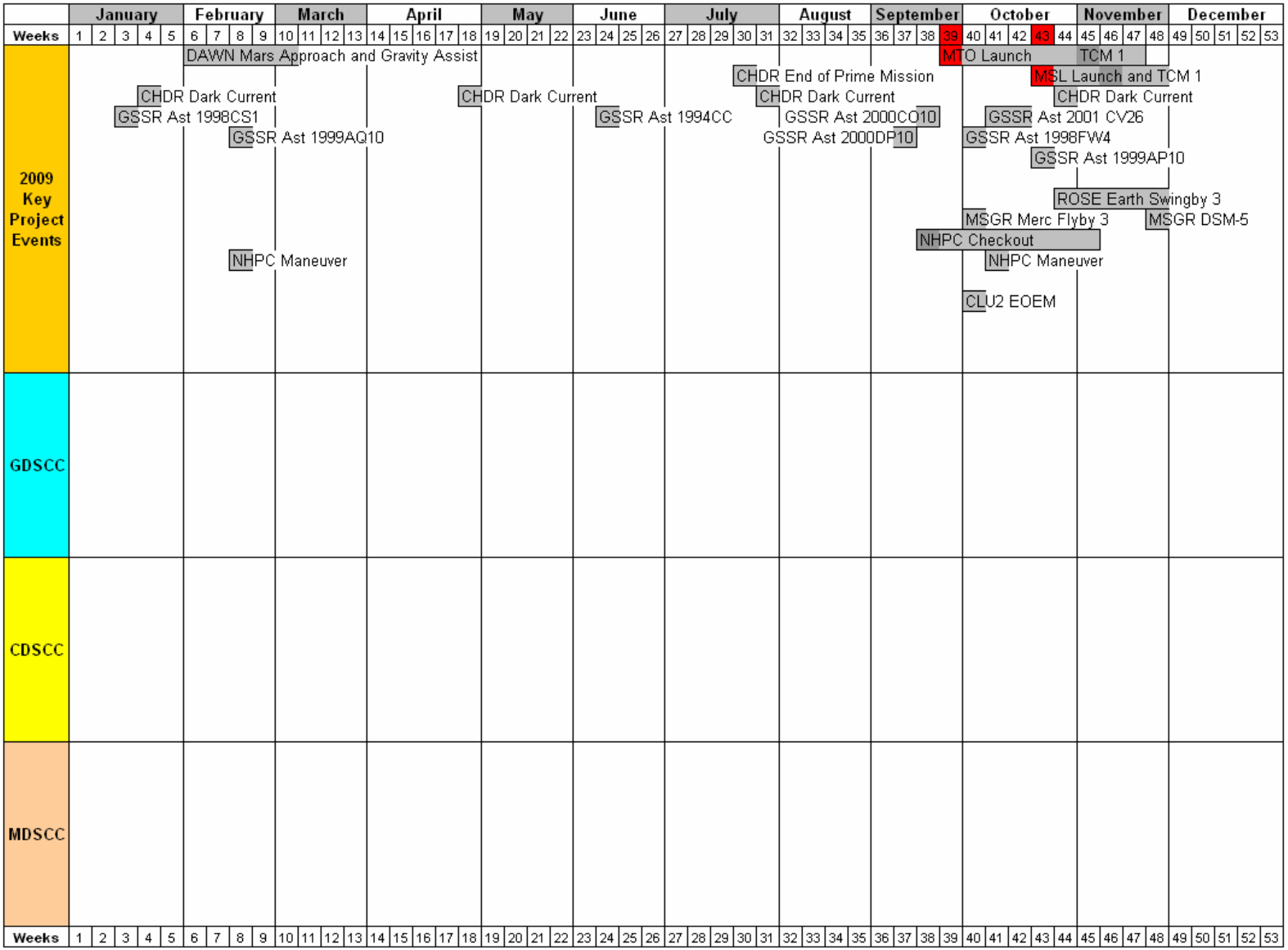
Revised: November 17, 2004

Antenna Downtime Status And Forecast 2008



Revised: November 17, 2004

Antenna Downtime Status And Forecast 2009



Revised: November 17, 2004

DSN Resource Implementation Planning Matrix by Complex

Complex	Station	Subnet	S-Band		X-Band		Ka-Band		NSP
			Down	Up	Down	Up	Down	Up	
10	DSS-14	70M	✔	✔	✔	✔	N/A	N/A	✔
10	DSS-15	34HEF	✔	N/A	✔	✔	TBD	N/A	✔
10	DSS-16	26M	✔	✔	N/A	N/A	N/A	N/A	N/A
10	DSS-24	34B1	✔	✔	✔	✔	10/23/06	N/A	✔
10	DSS-25	34B2	N/A	N/A	✔	✔	✔	✔	✔
10	DSS-26	34B2	N/A	N/A	✔	✔	✔	N/A	✔
10	DSS-27	34HSB	✔	✔	N/A	N/A	N/A	N/A	N/A
40	DSS-34	34B1	✔	✔	✔	✔	04/11/05	N/A	✔
40	DSS-43	70M	✔	✔	✔	✔	N/A	N/A	✔
40	DSS-45	34HEF	✔	N/A	✔	✔	TBD	N/A	✔
40	DSS-46	26M	✔	✔	N/A	N/A	N/A	N/A	N/A
60	DSS-54	34B1	✔	✔	✔	✔	08/01/07	N/A	✔
60	DSS-55	34B2	N/A	N/A	✔	✔	✔	N/A	✔
60	DSS-63	70M	✔	✔	✔	✔	N/A	N/A	✔
60	DSS-65	34HEF	✔	N/A	✔	✔	TBD	N/A	✔
60	DSS-66	26M	✔	✔	N/A	N/A	N/A	N/A	N/A

N/A = Capability Not Planned xx/xx/xx = Capability Date Recently Change As of: 10/07/04

✔ ✔ ✔ = Capability Recently Exists ✔ = Capability Exists

DSN Resource Implementation Planning Matrix by Subnet

Complex	Station	Subnet	S-Band		X-Band		Ka-Band		NSP
			Down	Up	Down	Up	Down	Up	
10	DSS-16	26M	✔	✔	N/A	N/A	N/A	N/A	N/A
40	DSS-46	26M	✔	✔	N/A	N/A	N/A	N/A	N/A
60	DSS-66	26M	✔	✔	N/A	N/A	N/A	N/A	N/A
10	DSS-27	34HSB	✔	✔	N/A	N/A	N/A	N/A	N/A
10	DSS-24	34B1	✔	✔	✔	✔	10/23/06	N/A	✔
40	DSS-34	34B1	✔	✔	✔	✔	04/11/05	N/A	✔
60	DSS-54	34B1	✔	✔	✔	✔	08/01/07	N/A	✔
10	DSS-25	34B2	N/A	N/A	✔	✔	✔	✔	✔
10	DSS-26	34B2	N/A	N/A	✔	✔	✔	N/A	✔
60	DSS-55	34B2	N/A	N/A	✔	✔	✔	N/A	✔
10	DSS-15	34HEF	✔	N/A	✔	✔	TBD	N/A	✔
40	DSS-45	34HEF	✔	N/A	✔	✔	TBD	N/A	✔
60	DSS-65	34HEF	✔	N/A	✔	✔	TBD	N/A	✔
10	DSS-14	70M	✔	✔	✔	✔	N/A	N/A	✔
40	DSS-43	70M	✔	✔	✔	✔	N/A	N/A	✔
60	DSS-63	70M	✔	✔	✔	✔	N/A	N/A	✔

N/A = Capability Not Planned xx/xx/xx = Capability Date Recently Change As of: 10/07/04

✔ ✔ ✔ = Capability Recently Exists ✔ = Capability Exists

JOINT USERS RESOURCE ALLOCATION PLANNING COMMITTEE

Resource Analysis Team

November 18, 2004

Napoleon Lacey

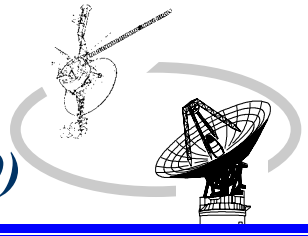
Mid-Range Scheduling Status

- **RESOURCE NEGOTIATION STATUS**
  - 2004 WEEKS 01 - 04 (THRU 01/30/2005) WERE RELEASED TO DSN SCHEDULING ON 11/05/2004.
  - 2004 WEEKS 05 - 08 (THRU 02/27/2005) ARE DUE TO BE RELEASED TO DSN SCHEDULING ON 12/03/04.
  - 2005 WEEKS 09 - 20 (THRU 05/22/2005) ARE AWAITING CONFLICT RESOLUTION
- The Mid-range Scheduling process has negotiated schedules 26 weeks ahead of real-time. Currently, there are 10 weeks of conflict-free schedules. Conflict Resolution is required for the following sixteen (16) weeks: 05 through 20.

Resource Allocation Review Board

Project Changes Since August 2004 RARB

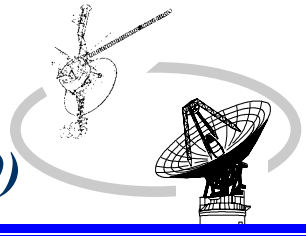
- **Cluster 2**
  - End of extended mission changed from 02/28/06 to 12/31/08
- **Gravity Probe B**
  - End of extended mission changed from 11/01/05 to 12/31/05
- **Kepler**
  - Launch date changed from 06/07/07 to 10/01/07
- **Lunar-A**
  - Launch date changed from TBD to 08/01/07
  - End of prime mission changed from TBD to 02/04/08
- **Mars Global Surveyor**
  - End of extended mission changed from 01/03/08 to 11/03/08
- **Mars Opportunity Rover**
  - End of extended mission changed from 10/08/05 to 09/30/06
- **Mars Spirit Rover**
  - End of extended mission changed from 10/08/05 to 09/30/05



Resource Allocation Review Board

Project Changes Since August 2004 RARB

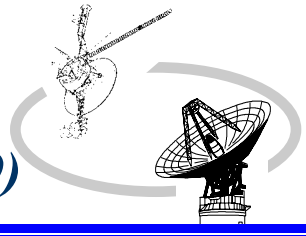
- **Mars Telecommunication Orbiter 2009**
  - Launch date changed from 09/07/09 to 09/22/09
  - End of prime mission changed from 09/07/16 to 08/19/20
  - End of extended mission changed from 09/07/20 to TBD
- **Mars Express Orbiter**
  - End of extended mission changed from 08/03/08 to 12/31/08
- **Polar**
  - End of extended mission changed from 09/30/05 to 09/30/06
- **SELENE**
  - Launch date changed from 01/15/06 to 11/01/06
  - End of prime mission changed from 05/30/06 to 11/21/06
- **Stereo Ahead and Stereo Behind**
  - End of extended mission changed from TBD to 05/17/11
- **Ulysses**
  - End of extended mission changed from 09/30/06 to 03/30/08



Resource Allocation Review Board

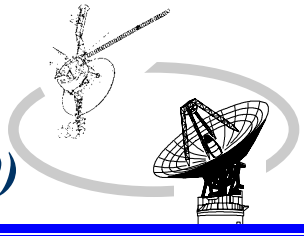
Project Changes Since August 2004 RARB

- **Venus Express**
  - End of prime mission changed from 08/19/07 to 04/09/06
- **Wind**
  - End of extended mission changed from 09/30/05 to 09/30/06



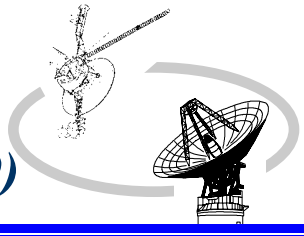
– Ongoing / Approved Projects –

Project	Acronym	Launch or Start	EOPM	EOEM
DSN Antenna Calibration	DSN	--	--	--
DSS Maintenance	DSS	--	--	--
DSN ZDD Calibration	DSN	11/01/04	--	--
European and Global VLBI Systems (EGS)	EVN	--	--	--
Ground Based Radio Astronomy	GBRA	--	--	--
Reference Frame Calibration (Cat M&E and Clock Sync)	DSN	--	--	--
Space Geodesy	SGP	--	--	--
Voyager 2	VGR2	08/20/77	10/15/89	09/30/06
Voyager 1	VGR1	09/05/77	12/31/80	09/30/06
Goldstone Solar System Radar	GSSR	04/01/85	--	--
Ulysses	ULYS	10/06/90	09/11/95	03/30/08
Geotail	GTL	07/24/92	07/24/95	09/30/06
Wind	WIND	11/01/94	11/01/97	09/30/06
SOHO	SOHO	12/02/95	05/02/98	12/31/08
Polar	POLR	02/22/96	08/23/97	09/30/06
Gravity Probe B (non Spacecraft support)	GPB	06/01/96	05/30/05	12/31/05
Mars Global Surveyor	MGS	11/07/96	02/01/01	11/03/08



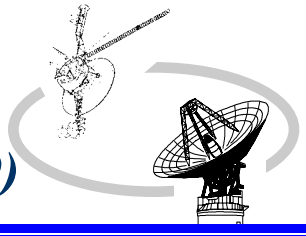
– Ongoing / Approved Projects –

Project	Acronym	Launch or Start	EOPM	EOEM
Advance Composition Explorer	ACE	08/25/97	02/01/01	09/30/10
Cassini	CAS	10/15/97	06/30/08	06/30/10
Stardust	SDU	02/07/99	02/15/06	- - -
Chandra X-ray Observatory	CHDR	07/23/99	07/24/09	07/24/14
Imager for Magnetopause-to-Aurora Global Exploration	IMAG	03/25/00	05/30/02	09/30/10
Cluster 2 - S/C #2 (Samba)	CLU2	07/16/00	02/15/03	12/31/09
Cluster 2 - S/C #3 (Rumba)	CLU3	07/16/00	02/15/03	12/31/09
Cluster 2 - S/C #1 (Salsa)	CLU1	08/09/00	02/15/03	12/31/09
Cluster 2 - S/C #4 (Tango)	CLU4	08/09/00	02/15/03	12/31/09
Mars Odyssey 2001	M01O	04/07/01	08/24/04	11/30/08
Wilkinson Microwave Anisotropy Probe	WMAP	06/30/01	10/01/03	09/30/08
Genesis	GNS	08/08/01	09/08/04	12/03/04
Advanced Tracking and Observational Techniques (ATOT)	ATOT	02/01/02	12/31/08	- - -
International Gamma Ray Astrophysics Lab	INTG	10/17/02	12/18/04	12/31/08
Hayabusa (MUSES - C)	MUSC	05/09/03	06/10/07	- - -
Mars Express Orbiter	MEX	06/02/03	02/11/06	12/31/08
Spirit (Mars Exploration Rover - A)	MER2	06/10/03	04/06/04	09/30/06



– Ongoing / Approved Projects –

Project	Acronym	Launch or Start	EOPM	EOEM
Opportunity (Mars Exploration Rover - B)	MER1	07/07/03	04/27/04	09/30/06
Spitzer Space Telescope (SIRTF)	STF	08/25/03	02/25/06	10/19/08
Rosetta	ROSE	02/26/04	12/31/15	- - -
Messenger	MSGR	08/03/04	03/19/12	- - -
Deep Impact	DIF	12/30/04	08/05/05	- - -
Mars Reconnaissance Orbiter	MRO	08/10/05	12/31/10	12/31/15
New Horizons	NHPC	01/11/06	04/17/16	TBD
Lunar - A	LUNA	08/01/07	02/04/08	- - -
Stereo Ahead	STA	02/11/06	05/16/08	05/17/11
Stereo Behind	STB	02/11/06	05/16/08	05/17/11
Space Technology 5	ST5	03/01/06	05/30/06	TBD
Dawn	DAWN	06/17/06	01/12/16	TBD



– Advanced / Planning Projects –

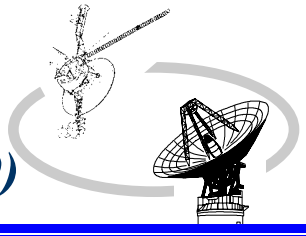
Project	Acronym	Launch or Start	EOPM	EOEM
Venus Express *	VEX	10/26/05	04/09/06	TBD
SELENE *	SELE	11/01/06	11/21/06	TBD
Kepler	KEPL	10/01/07	07/01/11	TBD
Phoenix	PHX	08/03/07	10/26/08	TBD
Mars Telecommunications Orbiter 2009	MTO	09/22/09	08/19/20	TBD
Mars Science Laboratory 2009	MSL	10/25/09	03/04/12	TBD
Space Interferometry Mission	SIM	02/14/10	08/30/20	TBD
James Webb Space Telescope	JWST	08/01/11	07/31/16	TBD
Mars Placeholder 2011	M11L	10/30/11	09/10/14	TBD
Mars Placeholder 2013	M13O	11/28/13	08/21/16	TBD

* DSN support may not be required for these missions

DSN Resource Implementation Planning Matrix by Subnet

Complex	Station	Subnet	S-Band Down	S-Band Up	X-Band Down	X-Band Up	Ka-Band Down	Ka-Band Up	NSP
10	DSS-16	26M	✔	✔	N/A	N/A	N/A	N/A	N/A
40	DSS-46	26M	✔	✔	N/A	N/A	N/A	N/A	N/A
60	DSS-66	26M	✔	✔	N/A	N/A	N/A	N/A	N/A
10	DSS-27	34HSB	✔	✔	N/A	N/A	N/A	N/A	N/A
10	DSS-24	34B1	✔	✔	✔	✔	10/23/06	N/A	✔
40	DSS-34	34B1	✔	✔	✔	✔	04/11/05	N/A	✔
60	DSS-54	34B1	✔	✔	✔	✔	08/01/07	N/A	✔
10	DSS-25	34B2	N/A	N/A	✔	✔	✔	✔	✔
10	DSS-26	34B2	N/A	N/A	✔	✔	✔	N/A	✔
60	DSS-55	34B2	N/A	N/A	✔	✔	✔	N/A	✔
10	DSS-15	34HEF	✔	N/A	✔	✔	TBD	N/A	✔
40	DSS-45	34HEF	✔	N/A	✔	✔	TBD	N/A	✔
60	DSS-65	34HEF	✔	N/A	✔	✔	TBD	N/A	✔
10	DSS-14	70M	✔	✔	✔	✔	N/A	N/A	✔
40	DSS-43	70M	✔	✔	✔	✔	N/A	N/A	✔
60	DSS-63	70M	✔	✔	✔	✔	N/A	N/A	✔

N/A = Capability Not Planned
xx/xx/xx = Capability Date Recently Change
As of: 10/07/04
✔ ✔ ✔ = Capability Recently Exists
✔ = Capability Exists



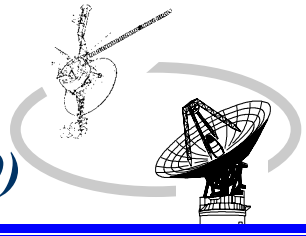
COMPLETED SPECIAL STUDIES/ACTIVITIES

- SOHO – Impact in 2005 of Weekly 26m Subnet 4 hour maintenance for Receiver Phasing
- SOHO – Analysis of Keyhole Periods in 2007
- Stereo Ahead and Behind Mission Support Update
- Ulysses Continuous Support in 2005 Feasibility Study (Swift – GRB)

http://rapweb.jpl.nasa.gov/studies.html

ON-GOING SPECIAL STUDIES/ACTIVITIES

- RARB Analysis
- Downtime Planning
- MADB/TIGRAS Testing and Training
- DSS-27 Closure Updated Study
- MRO Updated Requirements (Study will be re-published during the week of Dec 6)
- SELENE Updated Requirements
- GOES-N Launch Contention
- Rosetta Load Study – Post 2004 Requirements
- Venus Express – Radio Science Support
- Ulysses - 18-hour Per Day Support in 2005 Feasibility Study (Swift – GRB)



◆ SPECIAL STUDY SUMMARY

SOHO – Impact of Weekly 26M Subnet 4-hour Maintenance for Receiver Phasing

Purpose

Identify the effects of the new 26 meter antenna phasing requirements on SOHO 26M supportability in 2005. This study will include a forecast analysis for 2005 and an examination of the mid-range RAPBOOK conflicts already identified in weeks 01-14, January through mid-March.

Summary

The impact of the 26M antenna phasing on the SOHO mission in 2005 is projected to be minimal. SOHO will experience a 1-3 percent supportability reduction in 2005 due to the increased maintenance requirement while maintaining an average supportability greater than 85%. Although this is considered a workable percentage, substantial negotiation will be needed during the mid-range scheduling process to solve any remaining contention issues.

Conclusion

Based on current project requirements the 26M antenna phasing requirement is projected to cause a 1-3 percent reduction to SOHO's 26M supportability in 2005. The projected supportability during SOHO's HSO period is 87-90%. This is considered a workable percentage that should be handled during the mid-range scheduling process. RAPSO will continue to work with SOHO and other users of the DSN to maximize the time available for each individual user.

◆ SPECIAL STUDY SUMMARY

SOHO – The Supportability of SOHO Keyhole Periods in 2007

Purpose

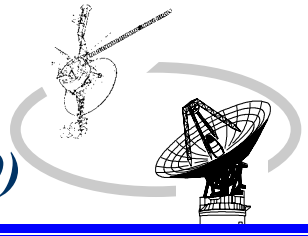
The purpose of this study is to forecast the supportability of SOHO Keyhole requirements periods during 2007.

Summary

SOHO is expected to receive greater than 85% of the requested time during keyhole coverage in 2007. This is considered a workable percentage which should be handled by the mid-range scheduling office.

Conclusion

Based on current project requirements SOHO can expect a high level of supportability during keyhole events in 2007. The projected percentages, which exceed 85%, are considered workable and should be handled by the mid-range scheduling office. RAPSO will continue to work with SOHO and other users of the DSN to maximize the time available for each individual user.



◆ SPECIAL STUDY SUMMARY

STEREO Ahead and Behind – New Launch Date and Updated Requirement

Purpose

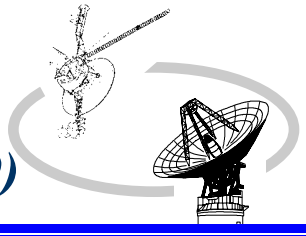
Evaluate STEREO Ahead and STEREO Behind requirements based upon a new launch day of February 11, 2006 and re-plan of major events to be supported on the Deep Space Network . This study will also compare launch requirements for the old date of November 15th, 2005 to the February 11th, 2006 new launch date. Additionally, the study will illustrate STEREO Ahead and STEREO Behind relative proximity to each other from launch to the 2nd lunar swing-by in week 20 of 2006.

Summary

The analysis of the DSN network loading and contention for the period of February 2006 through the End-Of-Prime Mission May 16, 2008 project that STEREO Ahead and STEREO Behind can expect to receive 89 to 95 percent supportability of their requested support during the life of the mission.

Conclusion

STEREO Ahead and Behind should receive 89 to 95 percent of their requested support from launch in week 6 of 2006 to end-of-mission in week 20 of 2008. Even though the launch slipped four months, the DSN supportability for STA and STB changed very little. The view periods will start with STA being in contention with the Mars projects from 50 to 100 percent and by the end-of-mission STB will be in contention with the Mar projects from 50 to 100 percent.



◆ SPECIAL STUDY SUMMARY

ULYSSES – Continuous Coverage Feasibility Study during March and April 2005

Purpose

Analyze the effect of Ulysses using the Gamma Ray Burst (GRB) instrument and heater during January through April (continuous coverage requested for March through April) 2005 in order to perform cross-calibrations with the GRB instrument on the Swift spacecraft. Swift is scheduled to launch on November 8th of 2004. NASA Headquarters has asked the Ulysses project to plan to activate the GRB instrument o/a March 1st, 2005 for approximately two months.

Summary

A visual inspection of the current mid-range schedule for ULYS and the "what-if" schedule having 24-hour coverage for ULYS confirms that ULYS cannot get continuous coverage during the requested time period from January through April 2005. In order for ULYS to get additional support outside the gaps already existing severe renegotiation with other missions is necessary.

Conclusion

Through a visual inspection of the current mid-range schedule that ULYS has and the "what-if" schedule showing 24-hour coverage for ULYS, it can be safely stated that ULYS cannot get continuous coverage during the requested time period from January through April 2005. In order for ULYS to get additional support outside the gaps already existing severe renegotiation with other missions is necessary.

JPL

Mars Exploration Rover

Report to the JURAP

November 18, 2004

Brad Compton &

Ben Toyoshima

MER as of 11/18/04

- Both rovers are healthy
- Exited Solar Conjunction
- Sol 312 - Spirit continues climbing Columbia Hills - over 40 meters above and 2700 meters away from our landing site on the Gusev plain.
- Sol 292 - Opportunity (almost) ready to leave Endurance Crater, a stadium size crater entered in June.
- October – December, 5 day per week uplink operation
- January – March, 7 day per week uplink operation

Mars Global Surveyor
Flight Operations Status

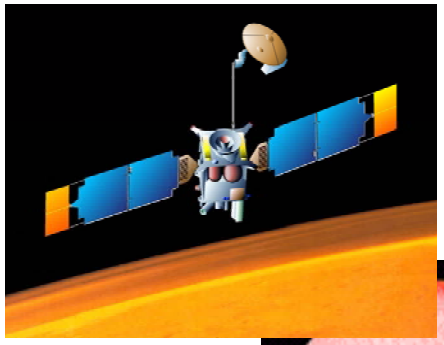
E.E. Brower

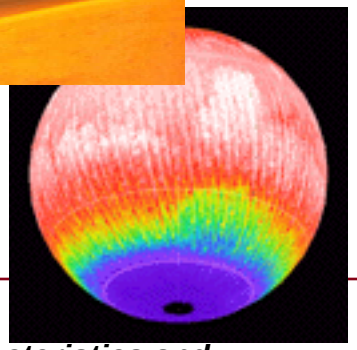
November, 2004

AGENDA

- Project Snapshot
- Recent Events/Accomplishments
- Mission Assessment
- Comments

Mars Global Surveyor





Salient Features

- ***Global mapping of Martian atmosphere, surface, magnetic field***
- ***Nadir pointed spacecraft***
- ***5 instruments (MOC imager, MOLA laser altimeter, TES - IR spectrometer, MAG magnetometer, RS radio science)***
- ***Launch date: November 1996***
- ***Mapping lifetime: One Mars year (687 days)***
- ***Provides relay capability for surface assets (Relay lifetime: 5 years)***

Science

- ***To characterize surface morphology at high spatial resolution to quantify surface characteristics and geological processes***
- ***To determine the composition and map the distribution of surface minerals, rocks, and ices; measure the surface thermophysical properties;***
- ***To determine globally the topography, geodetic figure, and gravitational field;***
- ***To establish the nature of the magnetic field and map the crustal remnant field;***
- ***To monitor global weather and thermal structure of the atmosphere;***
- ***To study surface-atmosphere interaction by monitoring surface features, polar caps, atmospheric dust, and condensate clouds over a seasonal cycle.***

Recent Accomplishments

Transitioned Through Solar Conjunction

- Nominal operations returned September 25
- E3 Mission Phase began September 27 with press release
- Final E3 Mission Plan completed and signed

Taking CPROTOs of science targets and automating process

As of October 31, 2004, 56 CPROTOs have been taken.
Conducting reconnaissance of 4 potential Phoenix landing ellipses
Began testing of Universal Targeting Slew Block November 1, 2004

Strategy developed during solar conjunction to preserve life of TES calibration lamp

TES backup calibration lamp failed on September 1, restored by power reset prior to COBE.
The TES interferometer to be operated monthly for 13 orbits beginning mid-November to continue record of seasonal changes prior to MRO aerobraking support in spring of 2006.

Negotiating LMA spacecraft/science contract extensions for E3 mission phase

Managing momentum buildup to avoid desats which limit targeting and mission life.

Transitioned to four part Solar Array stepping on October 20
Conducted RS egress scans on October 21
Options: more non-comm, weekly egress scans, autotrack/4-part and relay 16 +/-0.5 deg.

Future Plans

- **Continue automated ROTO/CPROTOs implementation and complete test phase for all comm configurations of beta supplement.**
- **Conduct TES lamp operation and confirm status to preserve MRO a/b support**
- **Complete process of extending LMA spacecraft and science contracts for E3 mission phase.**
- **Finish Single Gyro Attitude Determination (SGAD) development**
- **Begin three part SA stepping/orbit on December 2**
- **Continue monthly RS egress scans**

	October 2004	Mission Total
# of images Commanded	1767	199,568
# of images Received	1724	190,100
# of images Corrupted	270	26,419
Raw data return in MB	1091	196,341
# of ROTOs	30	1115
# of CPROTOs	4	59

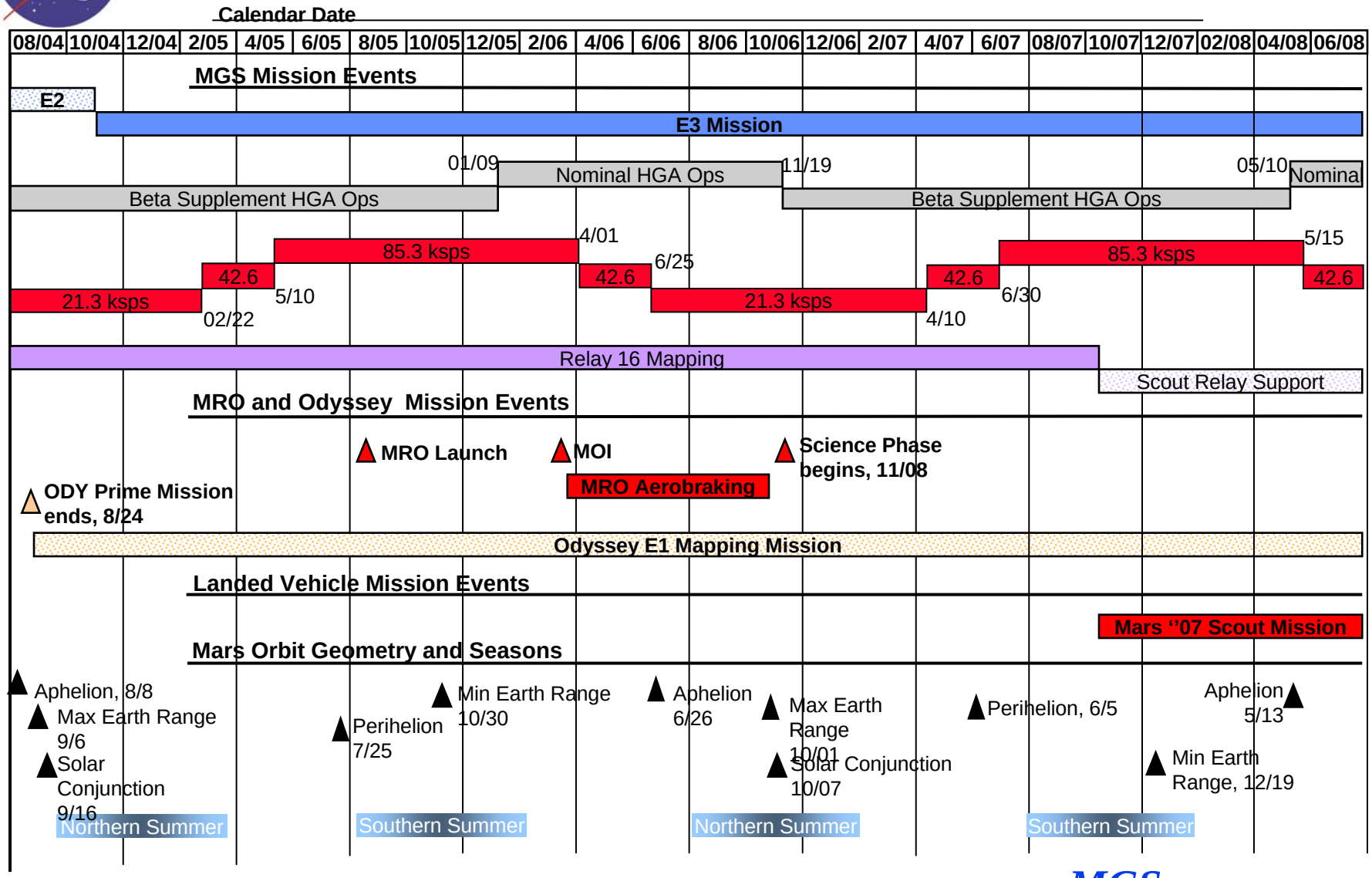
MOC Science in October

In October 2004, the MOC team began a vigorous narrow angle imaging campaign for the north polar region of Mars. Each Mars year, several factors have conspired to make imaging of specific targets in the north polar region a challenge. The primary issue has been data rate, which is almost always low during northern summer. In 1999, however, data rates were high, but the occurrence of the wide angle Geodesy Campaign and poor quality of the north polar, Viking-based "MDIM-1" presented difficulties. In 2000–2001, the second northern summer, the team found that there is a very narrow window of opportunity for high-quality (clear atmosphere) north polar narrow angle imaging. This period only lasts 2 to 2.5 months before dust storm activity picks up in the region. In 2002–2003, the third northern summer, MOC's north polar activities focused on documenting stratigraphy and production of sand to form dunes in association with steep arcuate scarps.

Now in its fourth northern summer, MOC efforts in the north polar region are mainly focused on (a) imaging layered outcrops that were not well-documented during the previous three Mars years, (b) acquisition of sub-meter cPROTO images of representative north polar materials and textures (particularly the residual ice cap), and (c) documentation of evidence for the exhumation of sand dunes from within polar materials. The main period for this year's north polar effort is underway and spans October and November 2004. The figures that follow illustrate some of October's results.

October marked the start of the E3 MGS Extended Mission. On 20 October, MOC began its fourth Mars year of observations from the Mapping Orbit. It was Ls 103° on 20 October, the same time of year that the Calibration mission subphase—the first MOC imaging from the Mapping Orbit, began in February 1999. One additional note—the MOC science/targeting staff greatly appreciated the efforts of the MGS navigation team on 19 October to produce a special SPK (orbit predict) product following the unexpected AMD earlier that day. This extra effort improved targeting efforts that week.

Mars Global Surveyor
E3 Mission Timeline



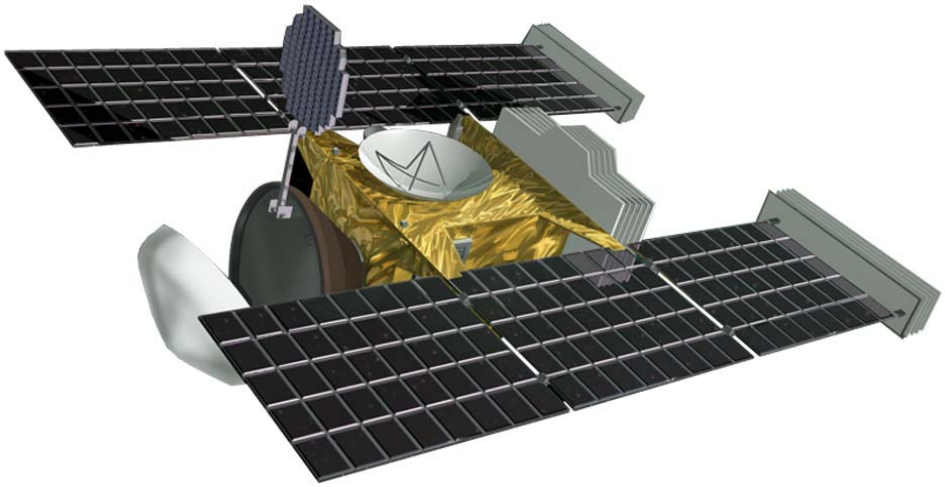
- **Spacecraft is in good health.**
- **Expect to fulfill most extended mission objectives**
- **Expect to satisfy MER EDL Requirements.**
- **Chances of operation through 2008 are good.**

- **None**

STARDUST

JOINT USERS
RESOURCE ALLOCATION
PLANNING COMMITTEE

R. E. Ryan
November 18, 2004
NASA Jet Propulsion Laboratory



http://stardust.jpl.nasa.gov

STARDUST

Report to JURAP

STATUS

SPACECRAFT IS HEALTHY (11/18/04)

PRESENTLY 3.26 AU from EARTH

00:54:16 RTLT

2.67 AU from SUN

APHELION OF 2.68 AU FROM THE SUN

7 WEEKS CENTERED ON OCTOBER17, 2004

LIMITED COMMUNICATION BECAUSE OF POWER RESTRICTIONS

(long period of one per week 3 hour duration tracks)

TELEMETRY BIT RATE IS 252 bps (on HGA/34 METER)

DSMS SUPPORT HAS BEEN GOOD THIS PAST PERIOD

http://stardust.jpl.nasa.gov

(there are some good shots, movies and information)

UPCOMING EVENTS

SUPERIOR CONJUNCTION JANUARY 30, 2005

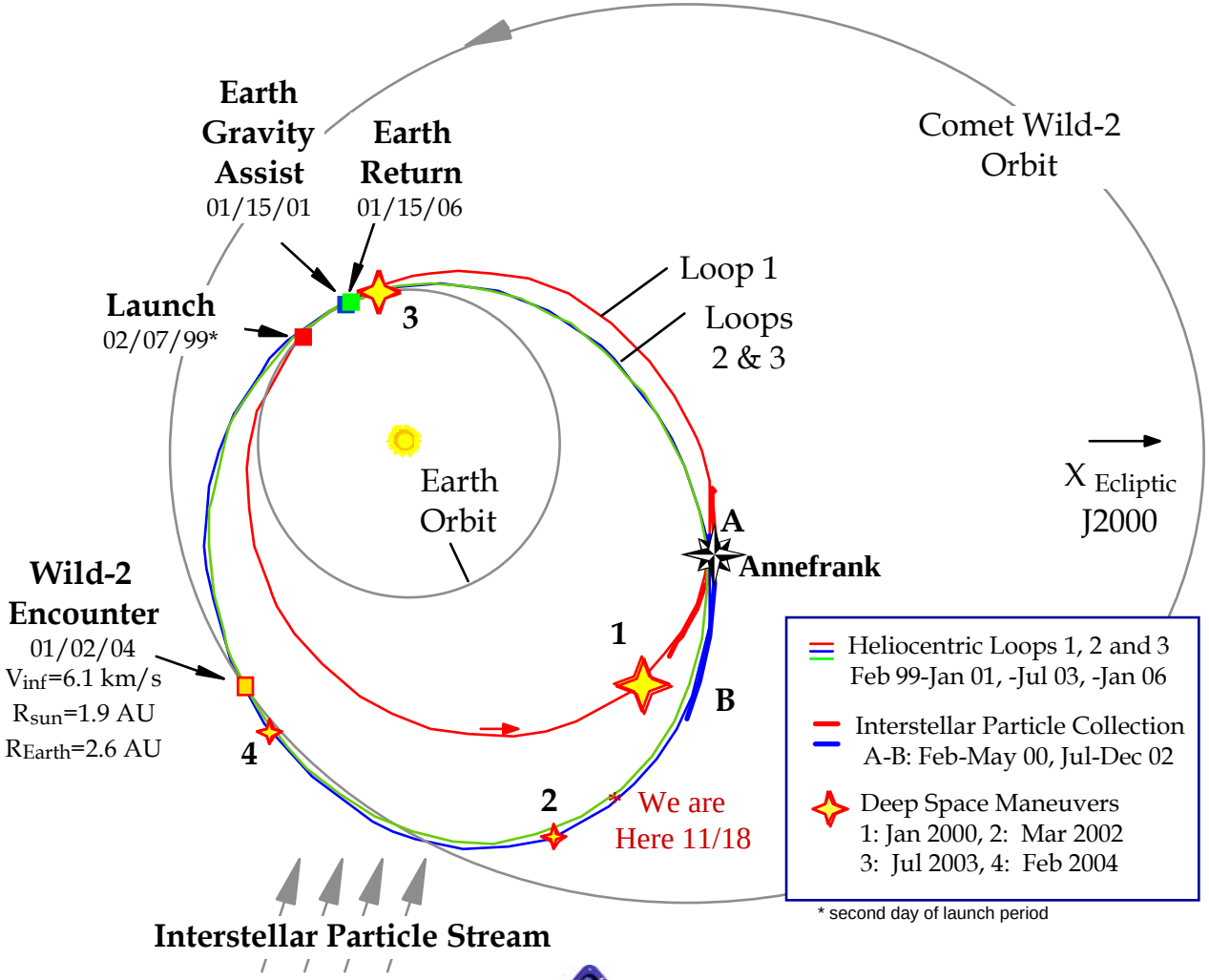
UNDER 2 DEGREES FROM JANUARY 27 TO FEBRUARY 3

TCM 16 ON April 6, 2005

Preparations for EARTH RETURN

STARDUST

Report to JURAP



ulysses

JOINT USERS RESOURCE ALLOCATION PLANNING COMMITTEE

http://ulysses.jpl.nasa.gov/

B. Brymer

November 18, 2004

NASA Jet Propulsion Laboratory

ULYSSES

JOINT USERS RESOURCE ALLOCATION PLANNING COMMITTEE

- NOMINAL SPACECRAFT OPERATIONS CONTINUE
- SPACECRAFT POWER AND THERMAL RECONFIGURATIONS AND INSTRUMENT CALIBRATIONS ARE PERFORMED AS REQUIRED
- SPACECRAFT EARTH-POINTING MANEUVERS ARE BEING PERFORMED ON A ROUTINE BASIS

ULYSSES

JOINT USERS RESOURCE ALLOCATION PLANNING COMMITTEE

REGARDING ULYSSES ASSISTANCE TO SWIFT/GRB CALIBRATION

- TARGET DATES REMAIN DYNAMIC AND DEPENDENT ON SWIFT SPACECRAFT ACTIVITY AND THEIR ABILITY TO SELF-CALIBRATE GRB INTRUMENT (√)
- ULYSSES SCIENCE TEAM WILL ACCEPT 6 HOUR DAILY GAPS IN COVERAGE
- RAP *GUESSTIMATE* OF ≥ 18 DAILY HOURS NEEDED FOR FURTHER ULYSSES COOPERATION
- ULYSSES SPACECRAFT AND OPERATION'S TEAMS AWAITING *GUESSTIMATE* AND DIRECTION FROM HQ